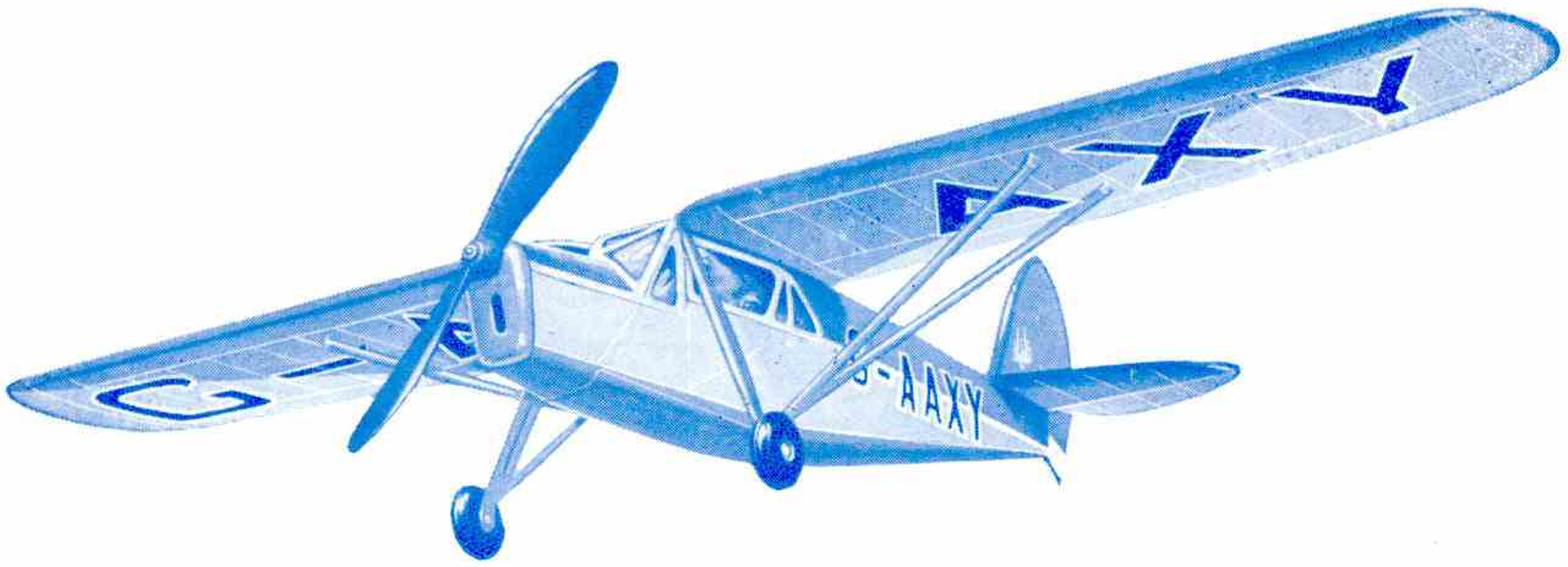
VOL. XVIII. No. 11 NOVEMBER 1933

MECCANO MAGAZINE

GIANT GEAR UNIT FOR PLATE MILL
(see page 826)

6D.

A *magnificent* NEW *Flying Model*



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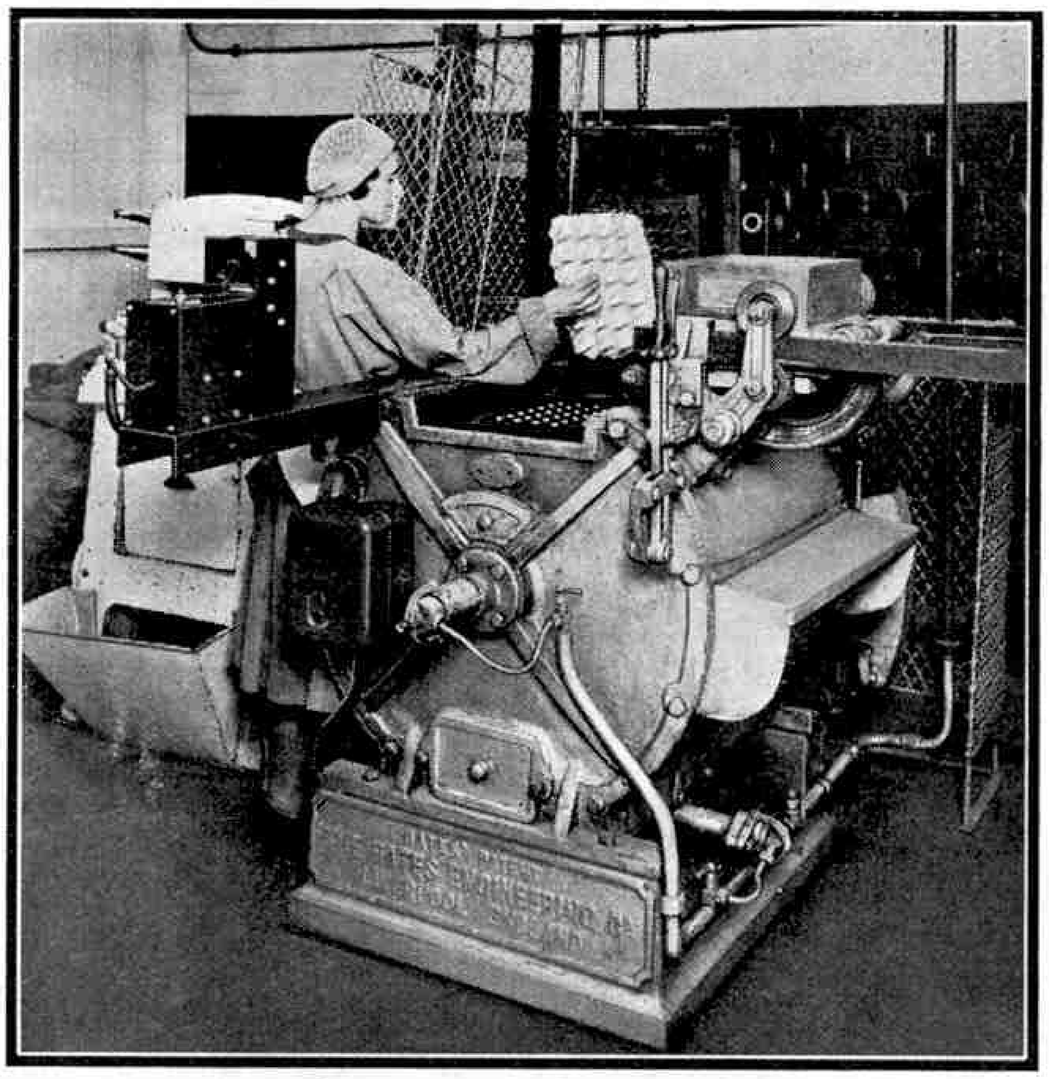
With the Editor

The Electric Eye

When I was a boy I used to revel in stories of mysterious electrical appliances that produced invisible rays of deadly power, or were capable of detecting the approach of an enemy and giving a silent warning; but I never read in those days of anything so marvellous as the photo-electric cell. Some of the wonders of this electric eye, as it is often called, are described in the article on page 869. It is far more sensitive to light than any human eye, and it responds instantly and with uncanny precision to the smallest variations in the intensity of the light that falls upon it.

The important part it plays in talking films was described in the "*M.M.*" for April and May, 1931, and the photograph on this page illustrates its use as a guard against accidents with machinery. The machine shown moulds cone-shaped biscuits or cornets for ice cream. The operator's hand would be seriously injured if it accidentally came between the two parts of the mould while these were closing, but an accident of this kind is effectually prevented, although there is no wire guard or any other protection of that nature. The electric eye incorporated in the machine is arranged in such a position that it detects the slightest movement of the hand towards the mould during the dangerous period, and instantly stops the machine. The operator must of course insert her hand into the machine to remove the completed cornets, but this is done when the upper part of the mould is rising. There is then no danger, and the electric eye watches, but takes no action.



A photo-electric cell stops this biscuit-moulding machine instantly if the operator's hand is in danger of being trapped. Photograph reproduced by courtesy of the British Thomson-Houston Co. Ltd.

Another application of the electric eye that promises to become as extensive as its use in making talking films is in television. A photo-electric cell forms a necessary part of every system of this kind yet devised, for it provides the link between the objects televised and the actual transmitter, by transforming light rays reflected from them into the electric impulses that are radiated through the ether.

Among other ingenious devices in which the electric eye is employed may be mentioned one for automatically opening the doors of a garage when the headlights of a car fall upon them. There is also an electric shooting gallery, in which the gun has no cartridges, but fires a beam of light on to a target the bull's eye of which consists of a photo-electric cell. If the gun is correctly aimed, so that the light beam falls on the bull, the electric eye comes into action and operates a relay that rings a bell.

The possibilities of the photo-electric cell seem to be almost unlimited, and there is little doubt that in the near future it will come into widespread use in the control of machinery of all kinds. I hope to publish a further article on this fascinating subject in an early issue.

The Triumph of the Motor Engineer

The great Motor Show held at Olympia, London, last month provided what was in many respects the most wonderful demonstration of mechanical efficiency the world has ever seen. It showed on the one hand the internal combustion engine brought to an astonishing pitch of perfection, with its enormous power harnessed to the special purpose of road transport; and on the other hand a simplicity of control that would have seemed impossible only a few years ago. In many branches of engineering the designer is able to concentrate his attention entirely on mechanical perfection, knowing that his machines will be operated, or at least supervised, by skilled mechanics. The motor engineer has been faced with the problem of producing mechanisms capable of being handled by those without any mechanical knowledge or skill, and he has solved the problem to an amazing degree.

At the beginning of the present century every journey by motor car was a great adventure, and the hardy spirits who set out to make one could never be sure that they would complete it without mishap, or indeed that they would ever arrive at their destination at all without calling in the aid of horses. Engines and transmissions alike were unreliable, and motorists were popularly supposed to spend more time crawling beneath their cars, covered with dust and oil, than in the driver's seat. Gear changing was then an ordeal, for it was difficult to persuade the crude gears to engage, and their protests against efforts to force them into mesh were loud and painful. Cars broken down by the roadside were a familiar feature. In those days 15 m.p.h. aroused far more comment than 70 m.p.h. would to-day, and horses reared and shied in terror when vehicles passed by at that speed. To-day cars can be driven at high speeds with little effort, and drivers are able to set out on long journeys with complete confidence in the reliability of their vehicles.

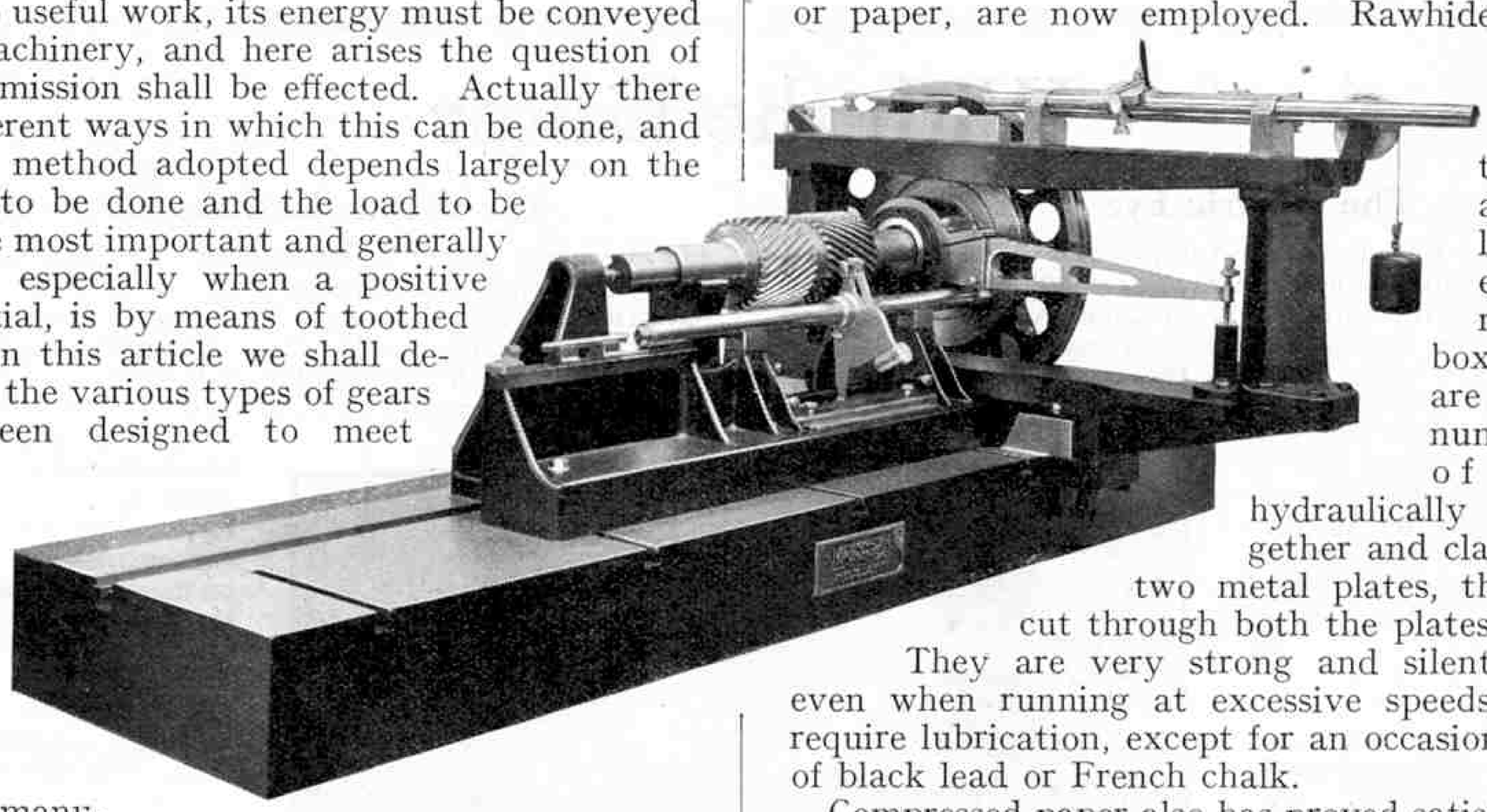
Our Special Christmas Number

Every year the Christmas number of the "*M.M.*" is eagerly awaited by Meccano enthusiasts throughout the world, and that for 1933 will be no exception. We are now actively engaged on its production and I can assure you that it will be the largest and best issue that has yet been published. Although the issue will make a new record in regard to size, and the number of attractive articles it will contain, there will be no increase in price. It will be on sale on 1st December, and I strongly advise every reader to place an order for it now with his usual dealer or newsagent, in order to avoid disappointment.

The Making of High-Speed Gears

Efficiency of Modern Power Transmission

ONE of the most important problems in engineering is that of power transmission. Before a steam engine, electric motor or other prime mover can be made to do useful work, its energy must be conveyed to suitable machinery, and here arises the question of how the transmission shall be effected. Actually there are many different ways in which this can be done, and the particular method adopted depends largely on the kind of work to be done and the load to be handled. The most important and generally used method, especially when a positive drive is essential, is by means of toothed gearing, and in this article we shall describe some of the various types of gears that have been designed to meet modern demands.



A pinion measuring machine that is capable of measuring errors in a finished pinion in units of one ten-thousandth part of an inch! For this illustration and those on the opposite page we are indebted to Metropolitan-Vickers Electrical Co Ltd., Manchester.

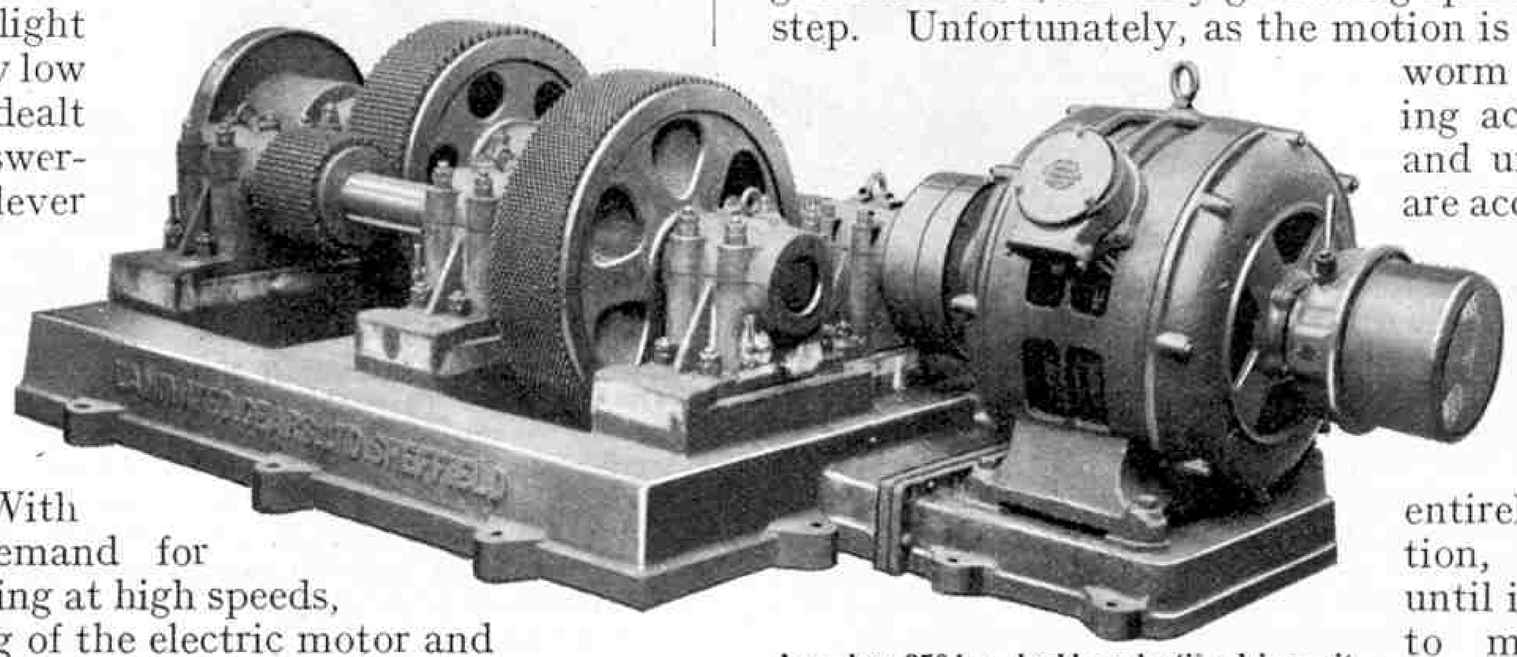
During the last 20 years great progress has been made in the design and methods of manufacture of gears, the object being to find the most suitable form of teeth for handling heavy loads at high speeds. At one time cast iron wheels, the teeth of which were dressed by hand by skilled millwrights, were used. So long as only light loads at comparatively low speeds had to be dealt with, such wheels answered quite well, but clever though the millwrights were at their job, it was impossible under such conditions to produce accurate and silent gears. With the ever-growing demand for gears capable of working at high speeds, created by the coming of the electric motor and the steam turbine, it became evident that improved forms of gear teeth and methods of production were vitally necessary if the utmost efficiency was to be obtained from the new power units.

It was not long, therefore, before engineers produced machines for cutting the teeth. The gears produced by the earliest machines were certainly a great improvement on the old cast gears, but there was still ample scope for improvement, and after much further experiment and research, automatic gear generating machines were invented. These can produce gears of an almost incredible degree of accuracy.

The material from which gears are made also has been the subject of considerable experiment, and for certain kinds of work non-metallic gears, made of rawhide or paper, are now employed. Rawhide gears in the form of ordinary straight-toothed pinions are used to a large extent in electric motor reduction gear boxes. The gears are composed of a number of layers of rawhide, hydraulically pressed together and clamped between two metal plates, the teeth being cut through both the plates and the hide. They are very strong and silent in operation even when running at excessive speeds, and do not require lubrication, except for an occasional application of black lead or French chalk.

Compressed paper also has proved satisfactory for use in some special cases. The gears are made from manilla paper hydraulically pressed to an enormous degree to form a solid substance, the strength of which is stated to be equal to cast iron.

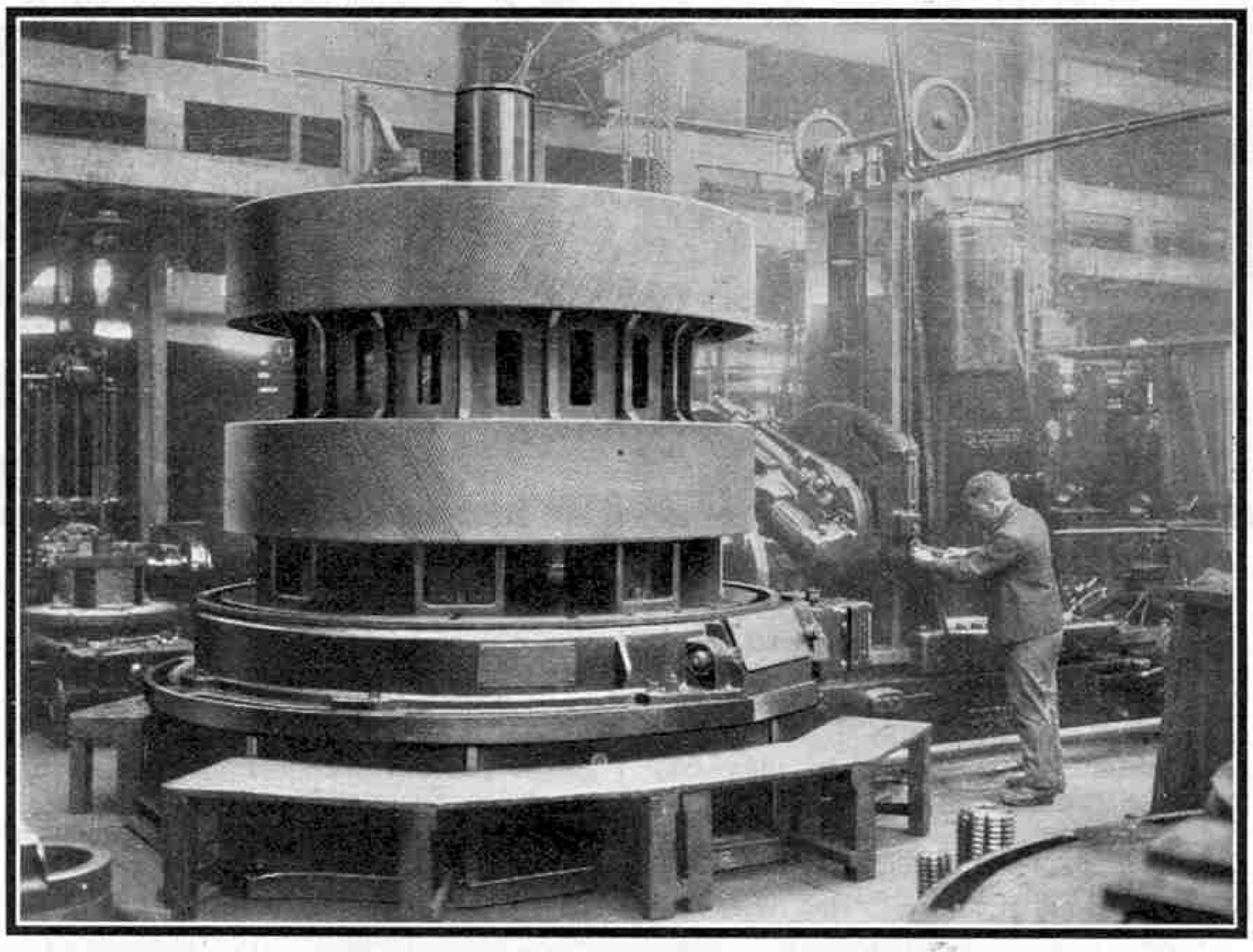
When it is required to provide a large speed reduction, and especially when space is limited, worm and wheel gears are used, for they give a big speed reduction in one step. Unfortunately, as the motion is transmitted from worm to wheel, a sliding action is produced, and unless the surfaces are accurately machined and constantly lubricated the losses due to friction are considerable. Cast worm gears are entirely out of the question, therefore, and until it became possible to manufacture very accurate machined worms and wheels this form of gearing was avoided in the best engineering practice, owing to its low mechanical efficiency. Nowadays, however, worm gearing is extensively used in motor cars and electric lifts, for the steering gear of ships, and for many other purposes. The shaft from the engine—or in the case of steering gear, from the steering wheel—carries a worm, and this engages with a wheel the teeth of which are of the same pitch, or distance apart, as the threads on the worm. A complete revolution of the worm is necessary



A modern 250 h.p. double-reduction drive unit, incorporating silent running Laminated Gears, which are described in the accompanying article. Illustration by courtesy of Laminated Gears, Sheffield.

to cause the wheel to move forward one tooth. Therefore if the wheel has 50 teeth the worm must rotate 50 times to turn the wheel once.

The finest examples of the skill of modern gear makers are probably those used in connection with marine high-speed turbines. When turbines were first employed for ship propulsion they were coupled direct to the propeller shaft, and as the propellers were of larger diameter than the turbines, they actually moved at a greater speed than the blades of the turbines. The result was that the propellers worked very badly owing to the fact that the water had not time to fill the cavity left behind as the blades rotated. The propeller thus was really working in a hole in the water, and it gave only a very feeble push. An attempt was made to hit a happy medium, but obviously any such compromise could not be entirely satisfactory or efficient, for it necessitated the turbines being made larger, and consequently using more steam than would be necessary under improved conditions. To be really efficient the propeller must work slowly, while the turbine must run at as high a speed as possible, in order to generate its utmost power. These seeming impossible opposites have been reconciled by the introduction of reducing gear.

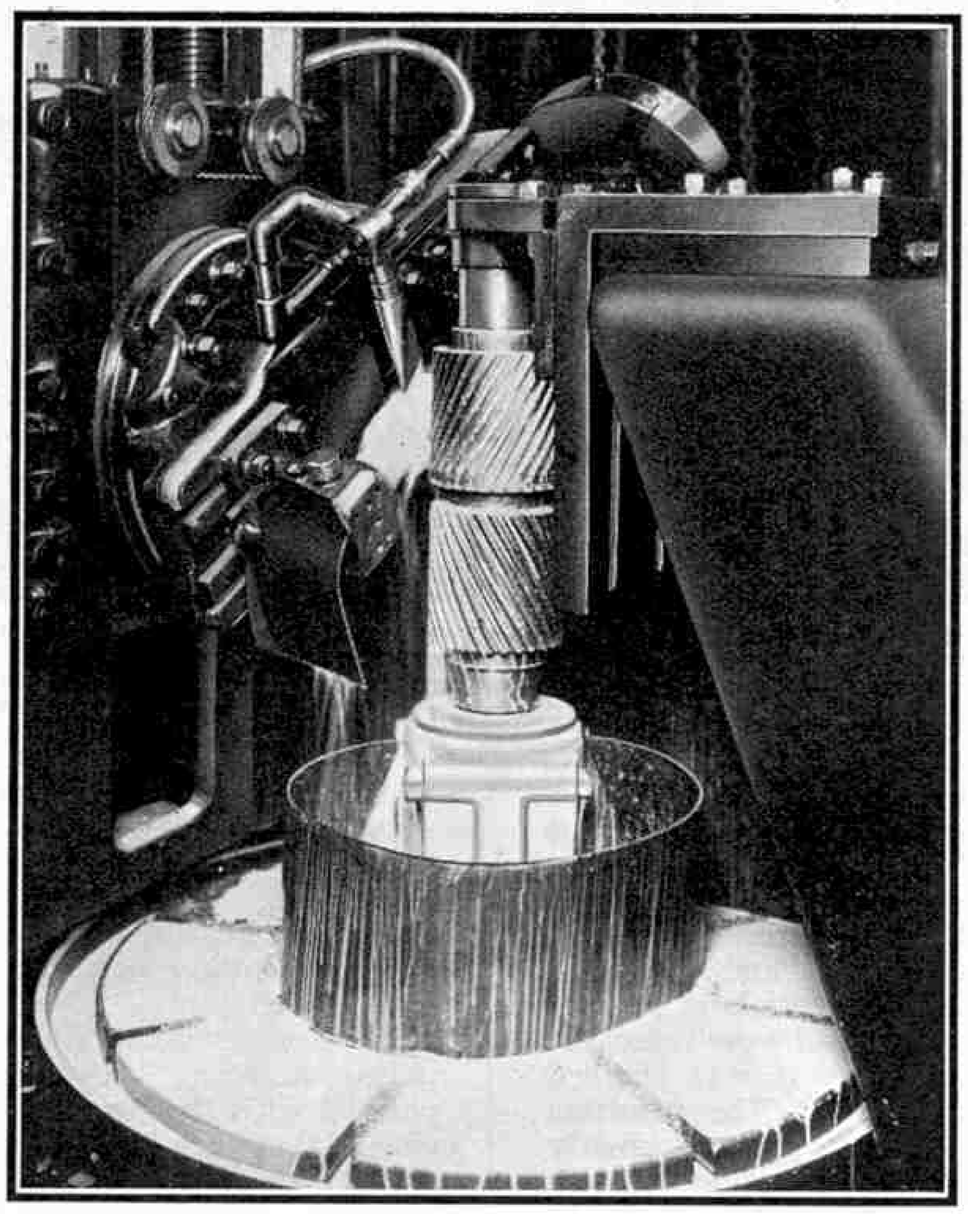


The teeth of a high-speed double helical gear wheel being cut on a hobbing machine. In the case of a very large gear, such as that shown here, approximately 170 hours continuous working are required to cut one of the helixes.

Reduction gears for marine work are divided into two classes, single reduction and double reduction. In the former the reduction ratio is seldom higher than 10 to 1 with a propeller speed of 200 to 250 r.p.m. With double reduction gears, however, the ratio of reduction is from about 20 : 1 or 50 : 1, and is sometimes as high as 100 : 1.

Numerous experiments were made to find the best form of gearing, and after extensive research work it was found that helical teeth were the most satisfactory for high-speed work. This form of gear is now used almost exclusively for transmitting very great power at high velocity.

Two fine examples of double helical pinions are shown on the cover of this issue. These were made by the English Steel Corporation Ltd. for driving a heavy tinplate mill. Special vanadium steel was used, and this was cast as blanks in moulds made from patterns. The cast weight of each pinion before the teeth were cut and the shaft machined was 6 tons 13 cwt., for the upper pinion in the illustration, and 7 tons 12 cwt., for the lower pinion.

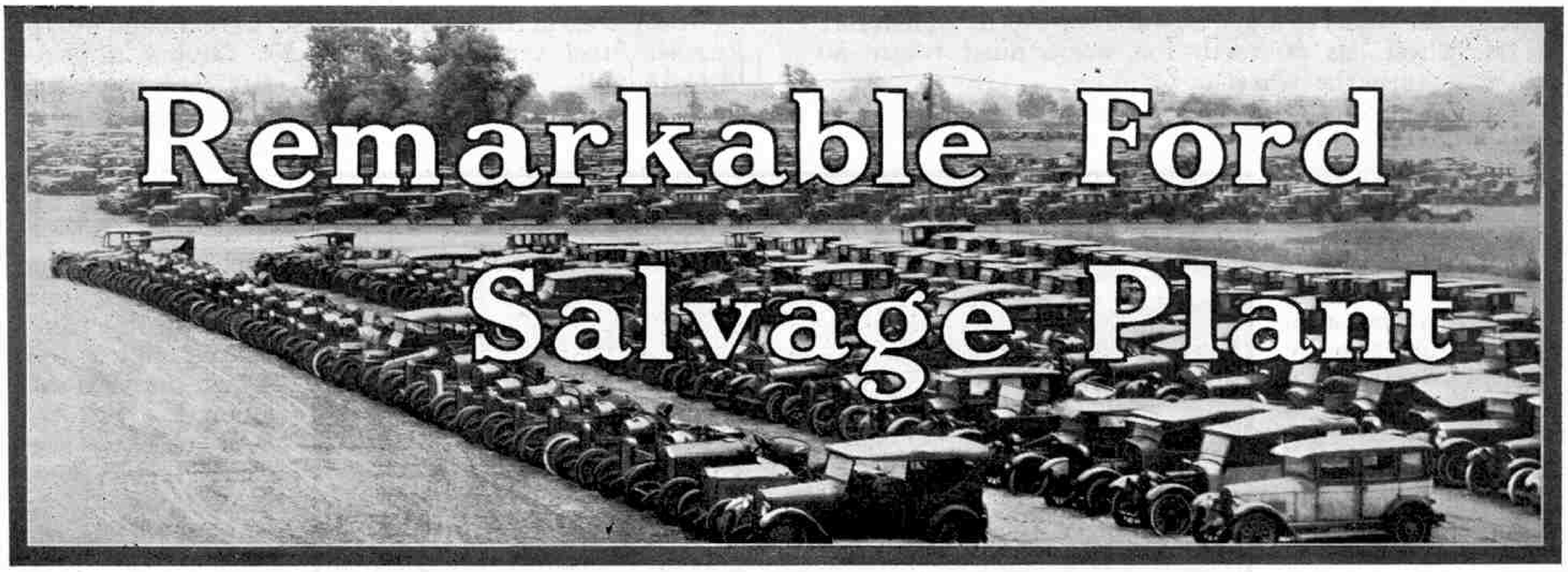


A small double helical pinion on a hobbing machine. The worm-shaped cutting hob is shown at work cutting the teeth on the upper half of the pinion.

As will be seen from the various illustrations accompanying this article, a helical toothed gear is simply one in which the teeth are in the form of a spiral line set slantingly across the face of the wheel. When looked at from the face, the teeth of a double helical gear present the form of a wide V. Helical teeth give much greater mechanical efficiency than the ordinary straight or spur teeth, and also they run with far greater smoothness and with an almost entire absence of noise. In action the teeth engage with a kind of rolling motion, rolling one upon another as it were, and lose contact or disengage gradually. Straight teeth, on the other hand, engage or disengage with a series of sudden meetings and partings, which result in rattle, rapid wear and low mechanical efficiency.

Metropolitan-Vickers Electrical Co. Ltd., Manchester, the largest firm making and using helical gearing in this country, have installed a special plant for cutting the teeth of helical gears to a very high degree of accuracy. In addition this company have also designed special checking and measuring devices that are capable of indicating errors in parts of the gear-cutting machines in units of one ten-thousandth part of an inch. Similar apparatus has been made for measuring errors in the finished pinions or wheels. So successful have these elaborate precautions proved that not a single case of tooth breakage has occurred in any of the gears made by this firm, although more than 500 gear reduction units, with a total horse power of over half a million, have been manufactured and installed.

(*Continued on page 831*)



Remarkable Ford Salvage Plant

COMPRESSING OLD MOTOR CARS TO 30 in.

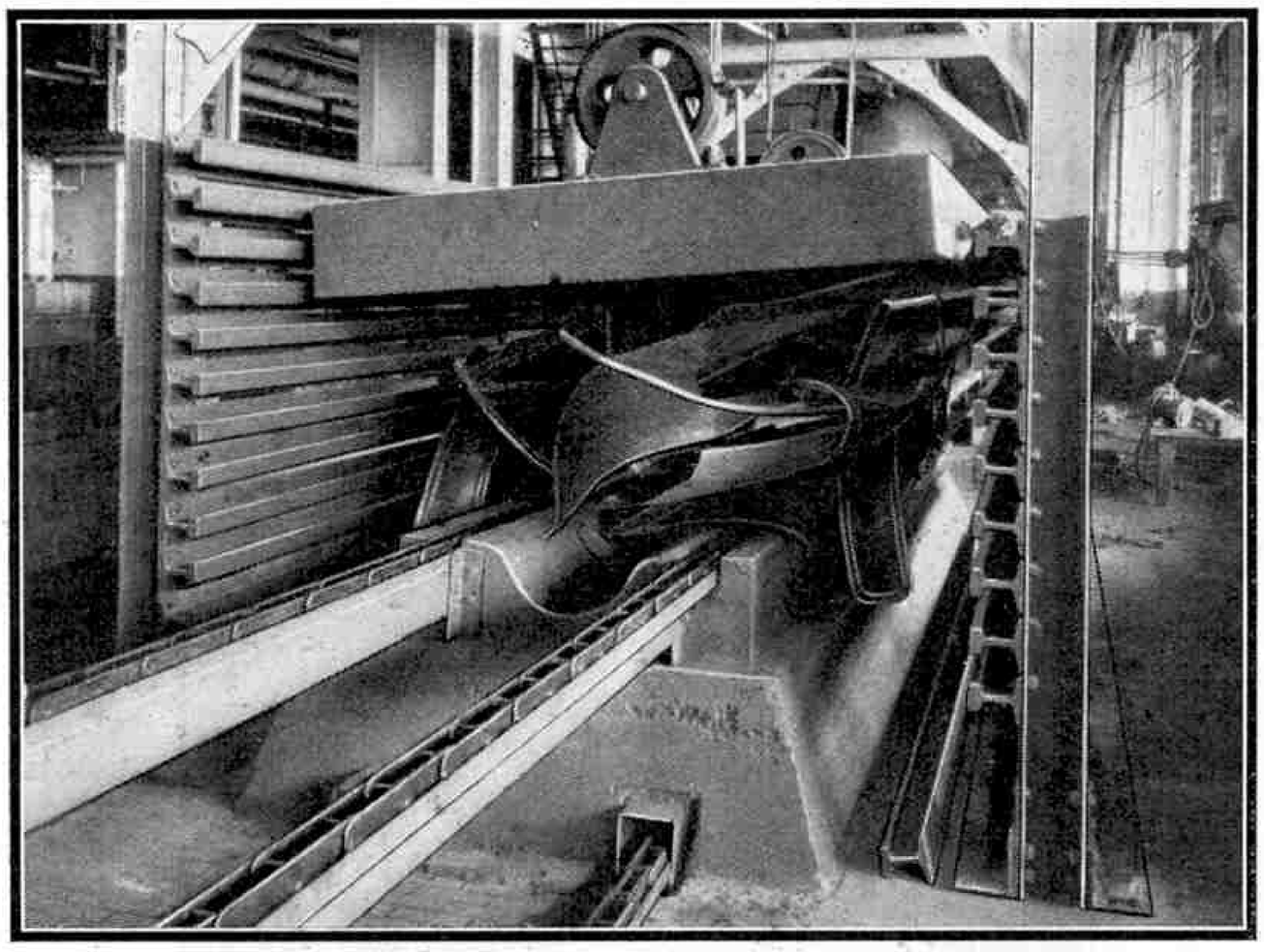
THE remarkable growth of the motor car industry in America during the past 10 or 11 years has brought with it the problem of how to dispose of the vast and increasing number of cars that are scrapped or otherwise put out of commission each year. The extent of this problem may be gauged from the fact that during the six years 1925-1931 the number of cars removed from service totalled 15,799,859, an average of 2,633,309 a year. Some are disassembled for salvable parts and remelting scrap; some are sunk behind breakwaters to serve as ballast, but the majority are discarded in sundry places to rust away and become unsightly as the years go by.

The wastefulness of this is seen when one realises that a present-day motor car, weighing 2,665 lb. without oil, petrol or water, contains 492 lb. of malleable and cast iron; 1,606 lb. of steel in various forms from heavy frame stock and axles to wire; 26 lb. of brass; 20 lb. of lead; 17 lb. of copper, and 5 lb. of tin. Thus every car has some value as scrap metal, but high disassembly costs usually prevent selling the scrap on a profitable basis.

Various efforts have been made in America during the past few years to salvage motor cars, but these attempts have been limited and have not accounted for the disposal of any large number of cars. It remained for the Ford Motor Company, Detroit, the first motor car makers to set up an assembly line for producing cars on a large scale, to install, in 1930, at their Dearborn steel plant, the first "disassembly" line on which cars could be salvaged on a similar scale. Three dismantling lines were used, one for Ford cars, the second for other makes, and the third for moving the salvage parts taken off. All materials of salvage value, such as glass, leather, tyres, copper and lead were removed, and when a car had been stripped completely it was crushed under a 22-ton weight down to the seat level. The resulting wreckage was then placed under a 1,000-ton press, formerly used to cut up ship scrap, and sheared into three sections of such size as to permit them to be charged as scrap into one of 10 open-hearth furnaces. This method of handling enabled 375 cars to be scrapped in a working period of 16 hours—two 8 hr. shifts—but it proved to be too slow, and improved facilities were installed and put into operation early in 1931.

The new plant is situated in a bay of the open-hearth building, on the charging side, but on a level below the charging floor. It includes one main disassembly line and an auxiliary conveyor, a 1,000-ton hydraulic press capable of compressing a car into a single bale, and a monorail conveyor for transporting the bales to a 400-ton open-hearth furnace that is the largest of its type ever constructed.

Old cars are purchased at a flat rate by the Ford company, and no restriction is placed on them as to age, condition or make; the only requirements are that each must have something resembling tyres and battery and must be delivered by a Ford dealer to the Dearborn works. Many of these cars are brought in on the long trailer trucks used to transport new cars from the factory to dealers.



The Ford works at Dearborn, America, includes a remarkable salvage plant for dealing with old cars, and the heading photograph above shows some of the 5,000 old cars awaiting their turn. The lower photograph shows a stripped car being compressed to a suitable size for charging into the furnace. The illustrations to this article are reproduced by courtesy of the Ford Motor Company Ltd.

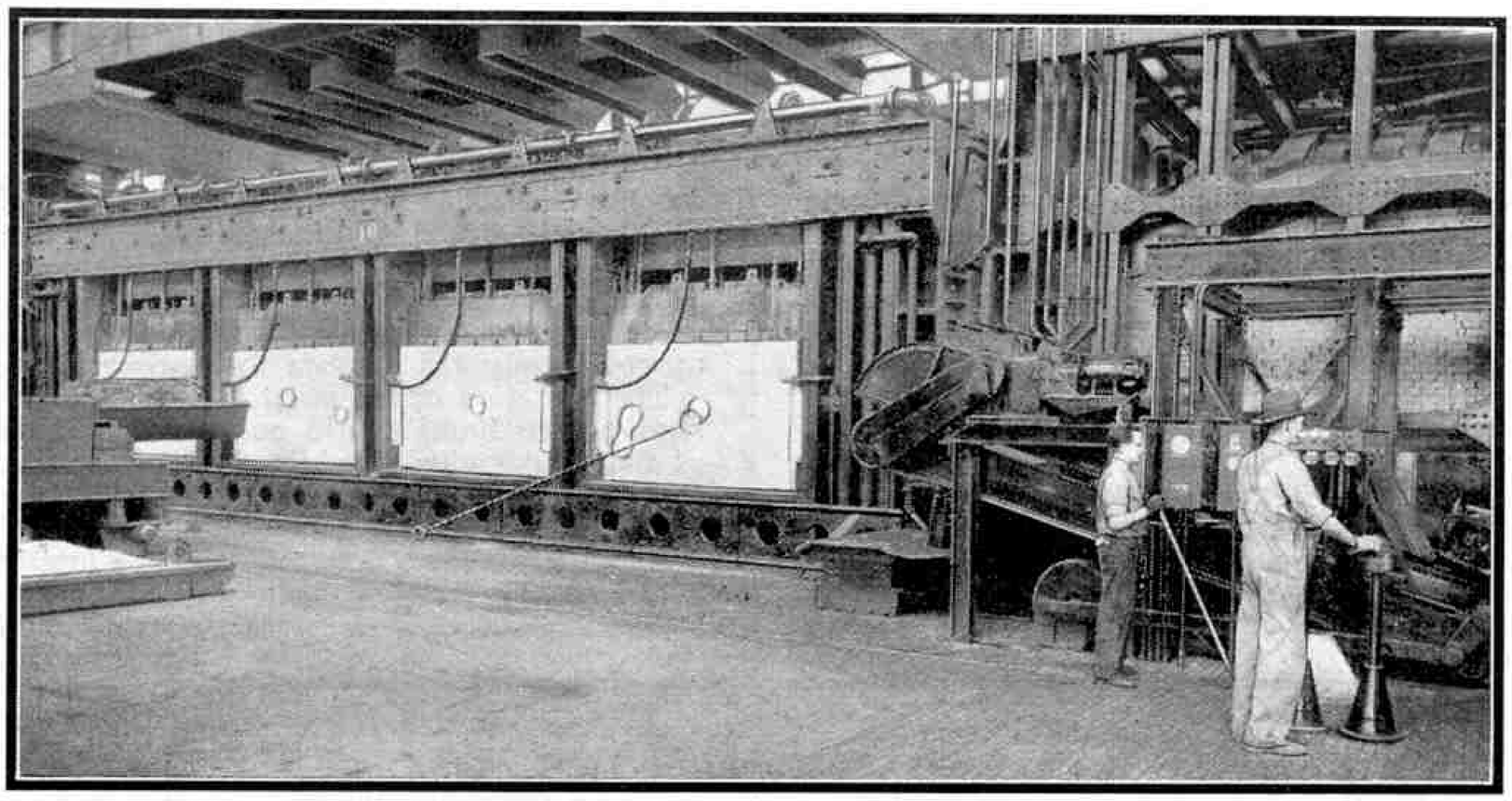
On an open storage ground adjoining the plant some 5,000 derelict cars in varying states of dilapidation stand lined up in orderly rows, awaiting their passage to oblivion. Trucks pull the cars in from the storage yard to the start of the disassembly line, a slow-moving double-chain conveyor elevated about 30 in. above the floor level, and a steel cable and an electric winch haul them up an incline on to the line, where they are spaced about 3 ft. apart. Workmen at once begin the removal of all parts that can be lifted out or taken off quickly. As the vehicles move slowly forward, groups of workmen continue the stripping process, removing sparking plugs, vacuum tanks, headlamp lenses and reflectors, radiators, steering wheels, dash equipment, wiring, storage batteries, window and windshield glass, upholstering, floor boards, bolts and nuts, tyres and rims, and many other parts that have a salvage value or are of non-ferrous metal.

The smaller parts are thrown into steel barrels, and the larger parts, including the glass, are laid on a conveyor that runs parallel with the disassembly line and carries them to a platform where they are loaded into trucks and taken to the salvage department. In this department the parts are sorted according to their suitability for reclaiming, fabricating into various products, or disposing of in other ways.

Glass is removed directly to the glass plant. Pieces that are of sufficient size, and not too severely scratched to make them unserviceable, are cut into small panes for use in the many Ford factory buildings. All broken and scrap glass is remelted in

a furnace, and the glass thus recovered can be put to various uses.

The upholstering and fabric removed from the car interiors is transferred to a small department to the left of the disassembly line. Here the fabric or leather is removed from the seat cushions, and the steel springs with their wooden frames are returned to the cars on the line. The reclaimed fabric is cut up by machines and sewn into polishing wheels, polishing pads, gloves, hand pads and other articles used by workmen in Ford manufacturing operations. Some of the material is used in making fender pads that are placed between finished fenders when these are stacked for shipment to assembly plants. Leather is cut into aprons for the operators of heating furnaces and forging hammers, and stuffing from the upholstery is sent to the salvage department.



View of the 4,000-ton open-hearth furnace from the charging floor. At the right is the conveyor that transfers the bales of scrap to charging boxes, to be picked up by the charging machine at the left.

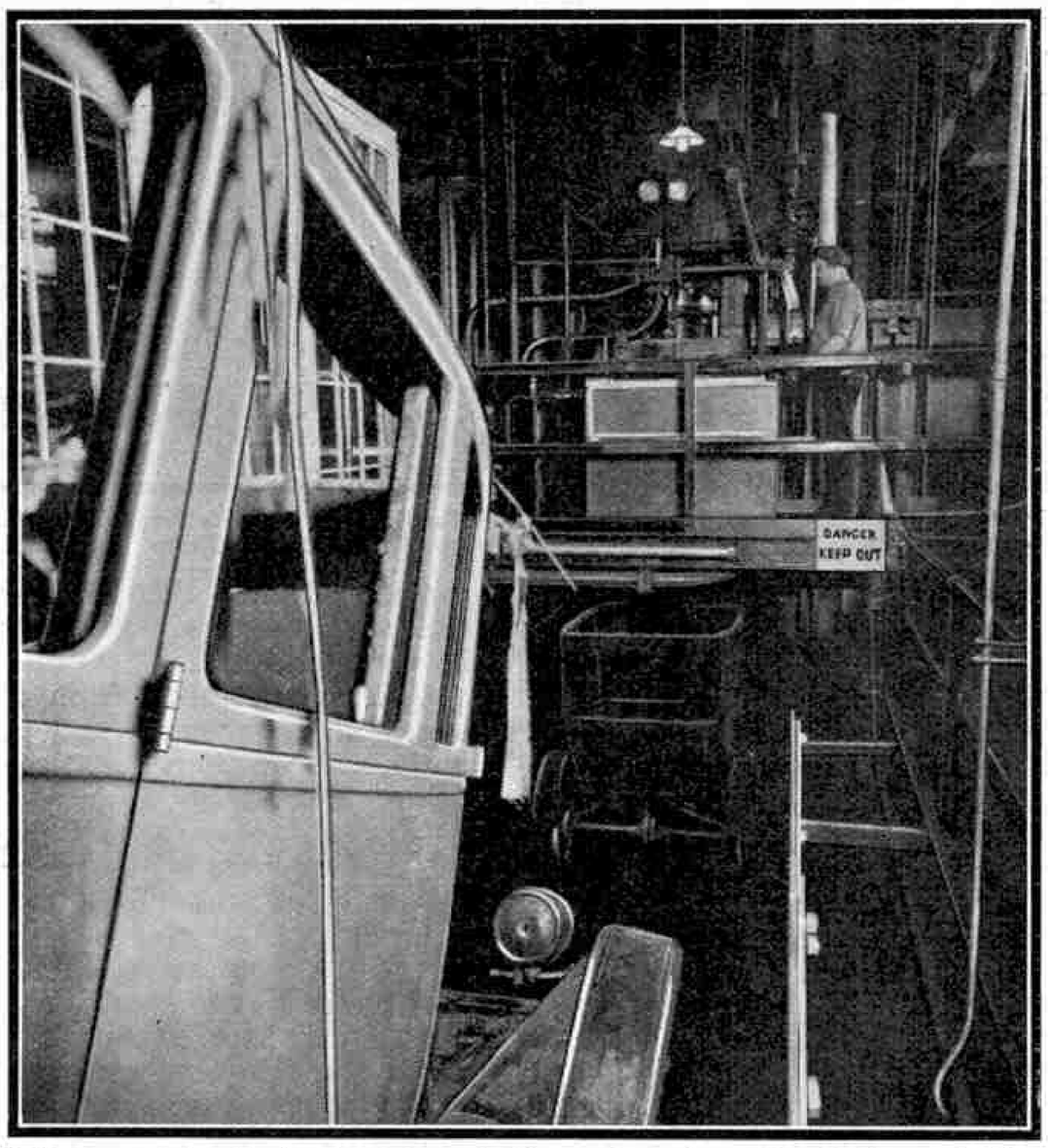
Tyres that appear to be worth salving are pulled off the rims so as to preserve them, but tyres of no value are placed with the rim under a sheer and cut in two to facilitate the removal of the tyre. All tyres are sent to the salvage department, where the good ones are reclaimed and the worthless ones sold as scrap rubber.

Every precaution must be taken to see that nonferrous metals do not go to the open-hearth furnace, where they would contaminate the steel, and the nonferrous parts are therefore placed in separate containers as they are removed from the cars. Particular attention is paid to the removal of all wiring. All nonferrous parts go to the salvage department for final disposal. No attempt is made to remove from the body framework and top wood parts that have no salvage value. This wood is compressed along with the metal parts, and quickly burns away in the high heat of the open-hearth furnace.

The engines are removed by cutting the engine supports with an oxy-acetylene torch, after which they are lifted out by an electric monorail hoist. Ford model "T" engines are delivered to a department to the left of the disassembly line, where, after being passed through a washing machine to give them a superficial cleaning from oil and grease and to facilitate disassembly, they are completely torn down into the component parts. The model "T" engine can be completely disassembled in 35 min., and as many as 135 have been handled during an 8-hr. working shift. It is interesting to note that many of the operations are made comparatively simple by using with reversed drive some of the machines originally utilised in assembling model "T" engines. Several presses with special punches and fixtures are used to remove wrist pins, bushings and other parts. As the various parts are removed they are suspended on hangers on an overhead conveyor and taken either to the salvage department or to the open-hearth scrap heap. Grey iron castings, including the blocks, cylinder heads, housings, flywheels and the like, are taken to the foundry, where they are remelted in the cupolas.

Engines from cars other than Fords are lifted by the hoist on to an overhead platform to the right of the disassembly line, where a workman removes the generators, starting motors, carburetters and other small parts. The engines are then pushed singly down a chute into a gondola car in an adjacent bay, and from there are moved outside the plant and placed under a "skull cracker" for demolition. In being broken up the engines disperse their copper, brass and aluminium parts, and these are picked up for salvage. What remains of the engines is taken to the foundry, and a few at a time are dropped into ladles of iron used in the casting of flywheels.

Some cars on the disassembly line are found to have aluminium bodies, and these must be removed before the cars can be compressed. Bodies of this metal are marked by an inspector, and before the car reaches the press it is lifted off the line by a crane and removed to an adjacent bay where the aluminium is stripped off for salvage. When this operation is completed the car is lifted back on to the line and moves forward toward the 1,000-ton hydraulic press. The speed of the disassembly line is so timed, and the number of workmen along the line so distributed, that dismantling operations are completed when each car approaches the incline leading down into the compression chamber of the press. This machine is said to be the world's largest baling press, and is of sufficient size and power to hold a complete motor car or truck and reduce it to a compressed bundle of suitable size for charging into the open-hearth furnace. It is 41 ft. long, 30 ft. high, 10 ft. wide and weighs over 500,000 lb. The compression chamber is 17 ft. long, 6 ft. 2 in. wide and 6 ft. 8 in. high.



Old cars, stripped of salvaged material, moving down the incline into the compression chamber of the 1,000-ton baling press.

As the cars reach the end of the disassembly line front end forward, they tip and by gravity roll down the incline, and come to rest in front of the eight-ton steel door of the compression chamber. The door is then raised to its full height, and two hydraulic pushers at the bottom of the incline move the car forward into the chamber. The pushers are then returned to their former positions and the steel door is lowered, effectively sealing the chamber.

At this point the compression cycle of the press is commenced. The car is first squeezed horizontally against the steel door by a ram that approaches the front of the car, and as the pressure continues the nose of the car slides upward on the ram. A pressure of 50 tons is sufficient to crush most light cars, but the horizontal ram of this huge press exerts a pressure as high as 360 tons, and reduces the 17 ft. length of the car to 30 in. When the ram reaches the maximum of its

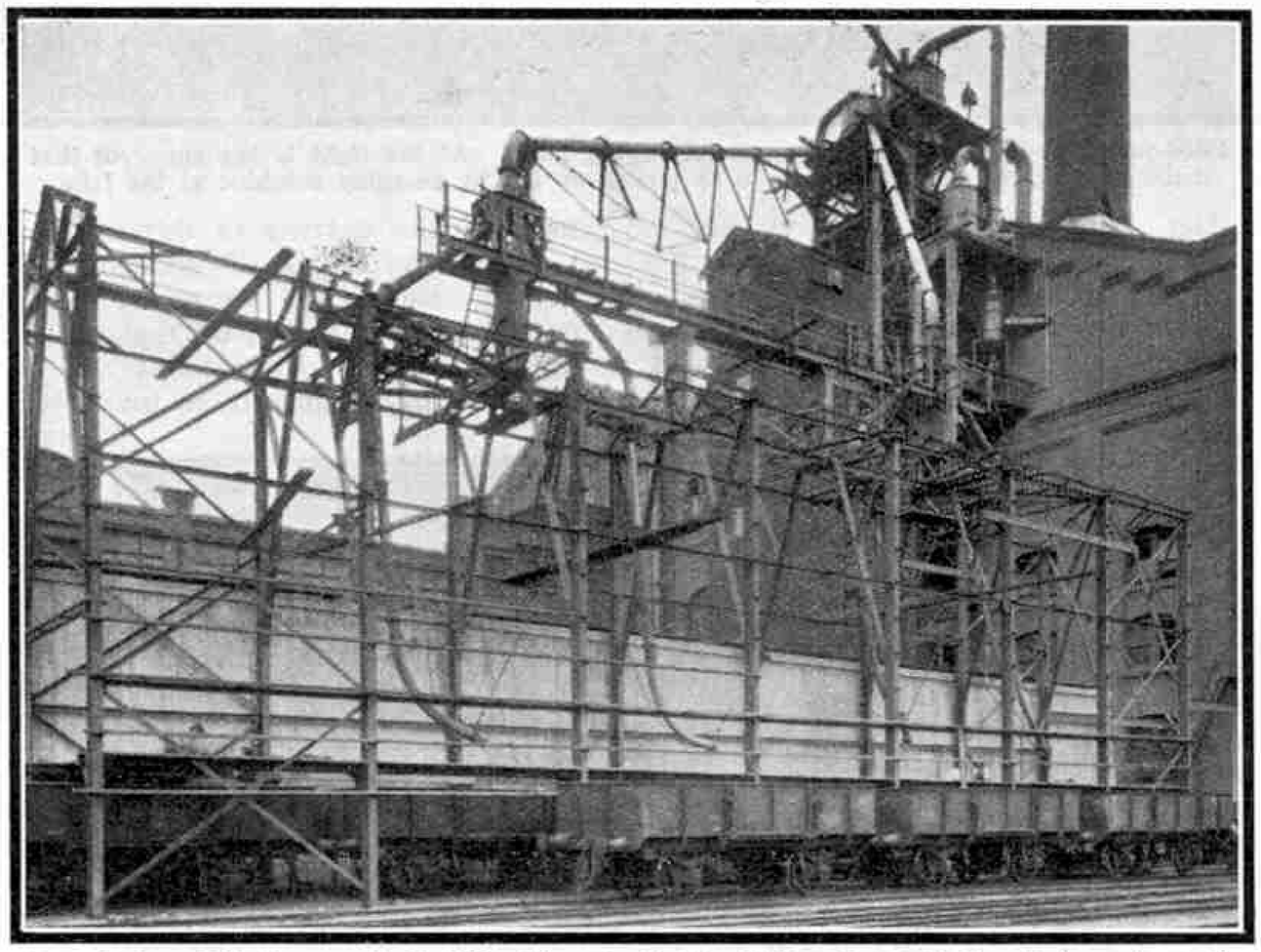
(*Continued on page 831*)

Coal Handling by Pneumatic Power

Interesting Installation at Sydney, N.S.W.

THE pneumatic system of coal handling is becoming increasingly popular with large coal users, and already has been adopted by several power stations and big industrial concerns. The reason is that the suction system is remarkably flexible, and in addition has the advantages of being dustless, labour saving and, in many cases, more rapid in operation than mechanical appliances. The pneumatic type of plant takes more power, but it is claimed that in many cases it actually costs less to operate than flexible grab and similar plants.

The latest electric generating station at which the pneumatic system of coal intake has been adopted is the Ultimo power station at Sydney, Australia. This station, which is under the control of the New South Wales Railway Commissioners, supplies power to the Sydney tramways and electric railways, and is the most modern in Australia. Considerable extensions to the station have been carried out recently, and in consequence additional coal discharging facilities became necessary. The Ultimo engineers decided to adopt the suction system in preference to pneumatic appliances, partly in order to avoid the use of tipplers, which were undesirable on account of the dust nuisance and partly on account of the different sizes of trucks, varying in capacity from 17 tons to 30 tons, that have to be handled.



General view of the Pneumatic Coal Handling Plant at the Ultimo Power Station, Sydney, Australia. The illustrations to this article are reproduced by courtesy of Henry Simon Ltd., Stockport.

The existing plant was on the gravity bucket system and had a handling capacity of 50 tons of coal per hour; but in order to meet the requirements of the enlarged station an hourly coal intake of 100 tons per hour was required. The engineers therefore decided to install discharging and handling plant to sufficient capacity to deal not only with present needs, but also with possible future extensions, and to put in plant capable of handling up to a maximum of 140 tons of coal per hour.

The order for the electric intake plant was placed with Henry Simon Ltd. of Manchester, and the plant has now been completed and is running satisfactorily. This Ultimo plant is probably the largest pneumatic installation in the world for coal handling.

The pneumatic plant comprises two units each having a capacity of 70 tons per hour, and is arranged for discharging railway wagons of varying sizes and for delivering the coal to bulk band conveyors feeding the storage bunkers over the boilers or through swivelling chutes to the stockyard behind the track shed.

The railway wagons are discharged in a special track shed in which four suction pipes are arranged, each provided with a swivel joint, telescopic section, flexible section, and intake nozzle. The pipe lines are operated by each plant. Two braced pipe booms are arranged from the track shed to the receivers at the top of the tower, one boom being 105 ft. in length and the other 35 ft. From each boom two intake pipes branch out and pass through the roof of the track shed. A ball joint is arranged immediately above the telescopic section, so that the intake pipes can be moved easily to reach every part of the wagon; and as a result the wagons can be discharged completely without moving them once they have been brought into position in the track shed. Four wagons can be dealt with at one time, and during a test each plant handled coal at the rate of 74 tons per hour.

The pneumatic plant can be employed also for reclaiming coal from the stockyard and delivering to the conveyors feeding the bunkers over the boilers. For this purpose a large concrete hopper has been constructed in the stockyard, to which the coal is raked by a plough shovel operated by electric winches. At the bottom of this hopper are two fixed pneumatic nozzles connected to two pipe lines, by means of which the coal in the hopper is transported to the receivers at the top of the tower. The vertical lift is approximately 115 ft. from the hopper to the receiver.

The operation of the plant is as follows. A wagon (or wagons) having been brought into position in the track shed, the nozzle of the intake pipe is plumped into the wagon and the coal is carried by suction through the pipe to the receiver, where it is discharged. The nozzle, which is of special design for coal handling, is curved at its lower end, making it a simple matter to keep it well buried in the mass of coal. An auxiliary air inlet is provided at the upper end of the nozzle, so that more or less air can be introduced to join the stream of coal immediately it enters the nozzle. The amount of air can be regulated by means of a valve.

The lower end of the intake pipe is flexible to facilitate handling, and a telescopic section also is provided to enable the length of the pipe to be varied as required. The telescoping movement is controlled from the track shed by means of chains operating over pulleys. The bends immediately above the telescopic pipes are fitted with renewable plates formed of heavy cast iron sections.

The two main suction pipes are carried up to the top of the tower, where they enter the receivers. These pipes are suitably braced and are supported at their upper end from brackets bolted to the tower structure. Valves are provided so that the truck-discharging section of the plant can be shut off when it is desired to discharge coal from the hopper in the stockyard.

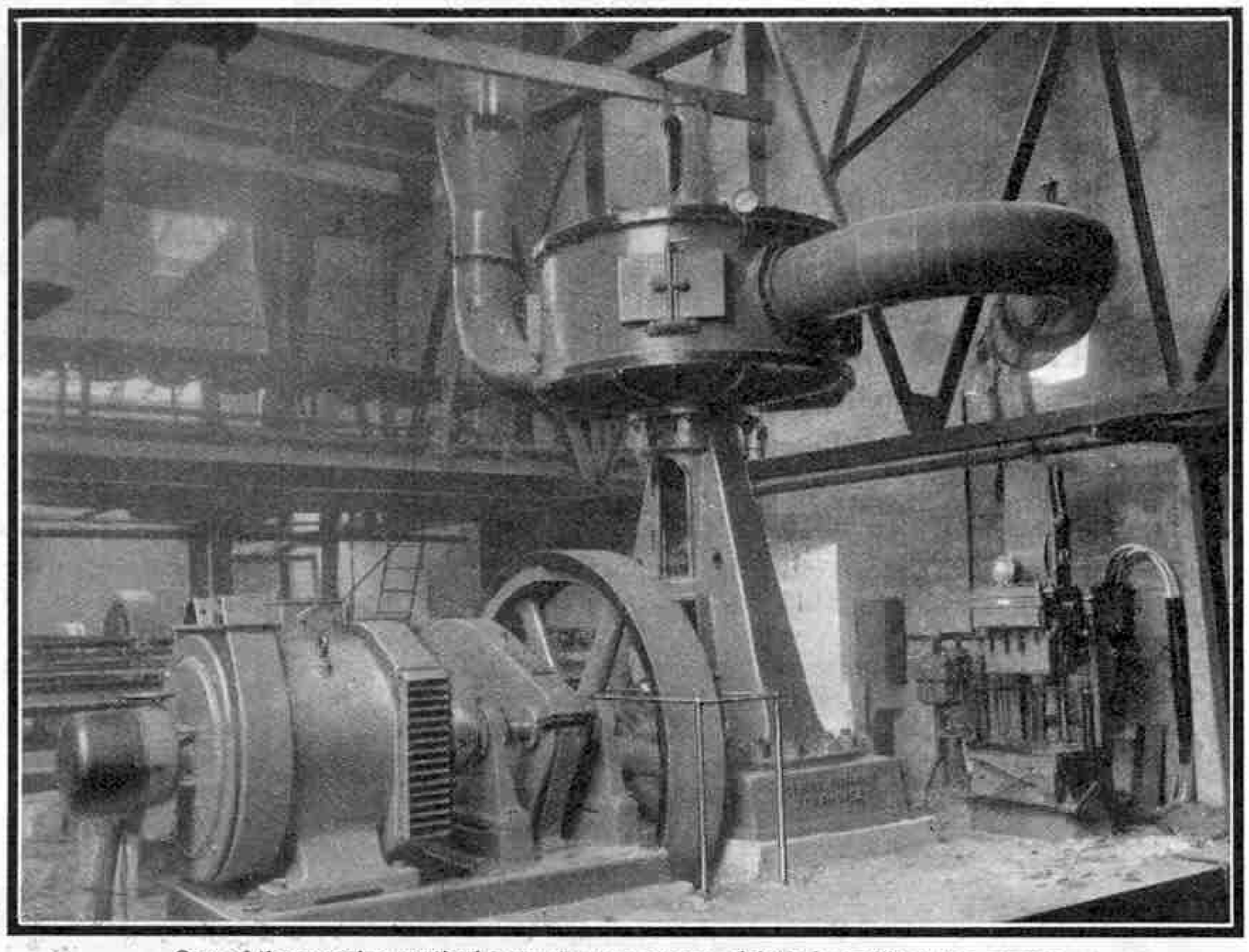
Coal is delivered from the receivers through mechanically-operated tipper seals, and passes to hoppers arranged above the automatic weighers. After weighing the coal passes to hoppers below the weighers, from which it is delivered to the belt conveyors feeding the bunkers in the boiler house. In addition to feeding the coal bunkers in the boiler house, the plant can be arranged to deliver to two swivelling telescopic pipes for delivering coal to the stockyard behind the track shed. These pipes can be swung round through a wide angle, and can be extended so as to cover the whole area of the stockyard.

The weighing equipment consists of two "Reform" patent automatic weighers, each having a capacity of 15 cwt. per weighment. These machines are of the equal arm beam type, the weight box being suspended at one end of the beam and the weigh bucket at the other end. The weighing, delivering and recording mechanism is entirely automatic, and the speed at which the machine works conforms to the rate at which coal is discharged and fed to the weigher.

The feed hopper and feed gates are specially designed for dealing with coal and other minerals, and a flexible hinged hopper wall is provided against which the feed gate closes. This wall consists of a number of closely spaced triangular plates mounted upon a spindle. If a portion of material passing through the feed hopper should be caught by the tip of the feed gate as the gate is closing, these places accommodate themselves to the irregularity, and form an effective seal against leakage of material while the gate

is closed. The plates free themselves automatically upon the next opening of the feed gate. Means are provided also for closing and locking the feed gate by hand.

The hopper feeding the weigher is provided with a feed control that ensures a consistent feed to the machine. This arrangement consists of a plate pivoted on knife edges and free to move under the influence of the coal in the hopper. The plate is connected by suitable levers to a catch controlling the feed gate, which is not released until sufficient coal has passed into the top hopper to deflect the plate or valve against the resistance of the counterweights. These are adjusted to resist movement of the control valve until at least a full weighment has accumulated in the hopper. A section on one side of the main hopper is partitioned off for this mechanism. In addition to ensuring accuracy and consistency of weighments, this device eliminates the spread of dust that would result from the feed running off during any part of the weighment. The catch on the feed gate may be hand manipulated if it is desired to clear the hopper when this contains less than a full weighment. The top hopper is provided also with a two-way valve, so that if desired the coal may be by-passed to the storage dump unweighed.



One of the massive vertical type vacuum pumps, driven by a 165 b.h.p. motor.

Heavy dust is extracted from the air entering the receiver with the coal by means of a cyclone incorporated in the receiver itself. This dust, which is valuable, is fed back into the coal through a rotary seal placed below the receiver in each plant, and driven by the same driving gear as that for the tipper. The dust passes into the stream of coal immediately it is delivered from the tipper seal, and enters before the coal passes to the weigher. The air, freed from the heavier dust, passes out at the top of the receiver, and is carried by mains to a water filter accommodated in the tower, where the air is washed and dried and then passed through the air receiver to the vacuum pump. The fine dust washed out in the water filter is delivered to a sludge tank, where it collects and is removed at intervals. This tank acts as a water seal and prevents any inrush of air.

The water for the filter is supplied from the water mains to a set of sprayers in the lower section of the filter, and it passes into the sludge tank, where it gradually overflows and is collected in a pond for further use. The water supply in the sludge tank is regulated by a ball float valve, thus maintaining a constant level to suit the working vacuum on the plant. After leaving the filters, the clean air passes through an air box provided with a screen, and thence to the pumps.

The vacuum pumps are of the vertical double-acting reciprocating type, specially designed for this class of work, each being driven by a 165-b.h.p. motor through double helical machine-cut gearing. They are mounted over the boiler house on a cement foundation 2 ft. in thickness, carried on heavy "H" section steel girders. The effectiveness of this running is shown by the fact that the pumps run entirely without vibration.

The pipe, booms, receivers, tippers, dust filtering plant, weighers, etc., are housed in a structural steel tower arranged alongside the boiler house and immediately above the track shed. The tower is 126 ft. high from ground level to the top of the receivers.

The plant was designed and constructed to the specifications of Mr. W. H. Myers, chief electrical engineer of the Ultimo electricity undertaking.

High Speed Gears—(*Continued from page 827*)

In the making of double helical toothed gears and pinions at the Trafford Park Works, Manchester, rigid specifications are imposed on the material used, and the pinion forgings are made sufficiently long to permit the removal of a portion of the material, from which test pieces are cut and subjected to bending and tensile tests. After rough machining the forging is thoroughly annealed and tempered, and then tested for uniformity of hardness.

The gear wheels are usually made of rims of forged carbon steel shrunk and pinned to cast-iron centres, which in turn are pressed on and keyed to main shafts of high-grade forged steel.

To cut the teeth the gear blank is mounted on a slowly rotating table driven by gearing, and the speed of the worm-shaped cutting hob is arranged with a definite ratio to that of the table. The cutter or hob starts the cut around the whole circumference of the blank as this rotates, and gradually progresses down the face of the blank, the table speed slowly advancing relative to the hob speed in order to form the helix. In the smaller gears the complete teeth are formed in one cut; with larger gears the cut is carried out in two stages. The first stage removes the major portion of metal, after which the hob, which wears to some extent, is ground to accuracy and the finishing cut then taken. The cut across one of the helixes, which in the case of a large gear may take as long as 170 hours, is always carried out in one continuous, uninterrupted operation. The process is similar in the case of pinions, but smaller machines are used.

Another very efficient and interesting form of modern gearing that is frequently used for high-speed transmission is the Laminated "Staggered-Tooth" Gear, an example of which is illustrated on page 826. These fine gears are manufactured by Laminated Gears, Sheffield. They are made from rings of high quality carbon steel, which are flattened accurately, and then bored to be a tight hammer fit upon a cast iron or steel hub or centre that has previously been machined to the correct size. The steel rings are clamped sideways under tremendous pressure, and between the rings there is arranged a series of thin washers that space the rings apart, and consequently prevent the teeth of one ring from rubbing against those of its neighbour in a sideways direction. Afterwards the diameter is finish-machined and then the teeth are cut just like those of any ordinary gear.

End pressure on the plates is then released, and each alternate plate or ring is rotated a distance of half a pitch, thus "staggering" the teeth. The utmost care is necessary to ensure that the rings are each staggered correctly half a pitch, and this is checked by accurate dial-indicator gauges. After this the plates or rings are again clamped rigidly together. Holes are drilled and reamed through the rings, and into them are driven circular keys or clamping screws, the ends of which are riveted over and the whole completed gear machined most accurately.

Ordinary solid steel gears working at high speed produce an unpleasant metallic sound, but in Laminated Gears this is almost eliminated by the thin washers placed between each alternate ring, thus making them very quiet in operation.

It is claimed for these gears that they provide double the extent of tooth contact between wheel and wheel that can be obtained with ordinary straight teeth, and that the use of rolled steel plates gives them better wearing qualities than other systems of construction. They have practically no backlash, and a further advantage is that their cellular-like construction tends to retain any grease used for lubrication and this further eliminates gear hum and prevents undue wear of the teeth so that the comparatively high cost of manufacture is amply repaid by efficiency and long life.

The unique construction of laminated all-steel staggered tooth gears makes them peculiarly suitable for all kinds of very high-speed gear transmission, the constricting bands of steel preventing the wheel from bursting due to centrifugal force set up during running. Under test laminated gears have been found capable of transmitting 400 h.p., at a speed of 11,000 feet per minute! They are used extensively for colliery haulage gear, machine tools, paper-making machinery, weaving and spinning shed line-shaft drives, pumps, and any type of gear transmission where quiet running and long life are essential.

Ford Salvage Plant—(*Continued from page 829*)

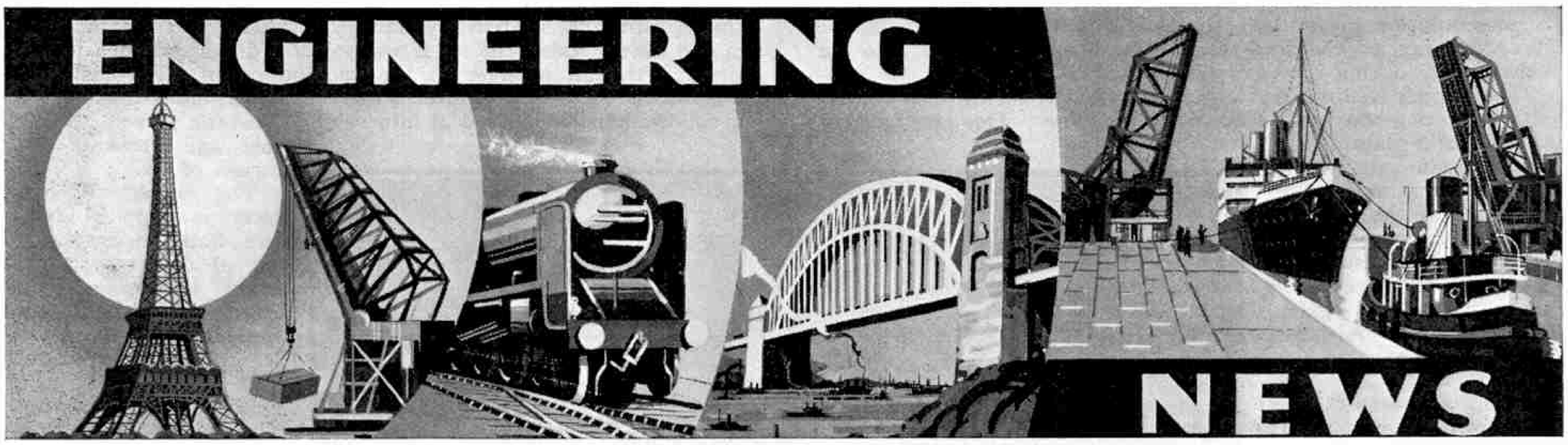
stroke the original 697 cu. ft. of space inside the chamber is reduced to 103 cu. ft. The ram holds the partially compressed car firmly against the door of the chamber, and a vertical ram weighing 17 tons and capable of exerting the enormous pressure of 1,025 tons, then descends from above to effect the final compression. By the time the descending ram comes to rest about 15 in. above the floor of the chamber the car has been compressed into a bale about 6 ft. long, 3 ft. wide and 15 in. thick.

When compression is completed the rams are withdrawn, the steel door is raised, and a mechanical pusher ejects the bale on to a short inclined conveyor that lifts it into one of the special carriers suspended from a monorail conveyor system. Hydraulic power for the press is supplied by a large double-cylinder oil pump operated by two 300 h.p. 720 r.p.m. synchronous motors. All the operations of the press are controlled by one man from a remote control platform just above the steel door, and he directs every move by merely turning a handwheel, to which all functions respond mechanically.

After being loaded on to the carriers of the monorail conveyor, the bales are moved to the end of the open-hearth charging floor, where they are automatically transferred to another conveyor that takes them up a small incline and loads them one at a time into the charging bucket. The loaded bucket is picked up by the charging machine and the bale is thrust into the 400-ton open-hearth furnace. When the scrap steel has been melted down it is run into crane-swung ladles, and emptied from these into either of two 600-ton storage mixers, in which it is kept at a uniform temperature until the adjacent 100-ton open-hearth furnaces are ready to receive it. In these furnaces the molten metal is refined.

The improved salvage plant has facilitated the handling of old cars, and has helped greatly toward the realisation of the industry's ideal—to scrap one old car for every new car that is produced.

We are indebted to the courtesy of the Ford Motor Co. Ltd., Detroit, America, for the information contained in this article.



World's Largest Reinforced Concrete Arch

A bridge that has recently been constructed at Stockholm has what is claimed to be the largest reinforced concrete arch yet built. The bridge is known as the Traneberg Bridge, and has been constructed to replace a pontoon bridge connecting the business quarters of Stockholm with the residential districts. The pontoon bridge was opened for traffic in 1914, and carries two tramway tracks in addition to a road, but it is not capable of dealing with the full volume of traffic now experienced in the city. The new bridge is about 150 yds. north of the pontoon bridge and is 1,902 ft. in total length, including the approaches. The reinforced concrete arch over the waterway has a clear span between abutments of 585 ft. The rise of the arch is 88.5 ft., and this gives shipping a clearance of 85.2 ft. above high water level over a width of 147.6 ft. The bridge is 90 ft. in overall width and carries two electric railway tracks, a 39-ft. roadway, two footpaths and two bicycle tracks.

The authorities are also building another bridge in Stockholm. This is known as the Vasterbron bridge, and it is made up of two steel arches that span the waterway with a pier in the middle of the channel. The two arches are 551 ft. and 670 ft. in span respectively, and the total length of the bridge, including approaches, is 1,968 ft.

Speedy American Elevators

No fewer than 75 elevators have been installed in the new Rockfeller Centre Building in New York, and 24 of these are claimed to be the fastest passenger elevators at present in operation in the world. During inspection tests these elevators were driven at a speed of 1,500 ft. per min., while one of them has been approved by official inspectors to travel normally at 1,400 ft. per min. The vertical distances travelled by the cars vary between 497 ft. and 797 ft. The fastest ones go all the way to the top of the elevator without stopping, and they complete a round trip to the top of the shaft and back again in 95 secs.

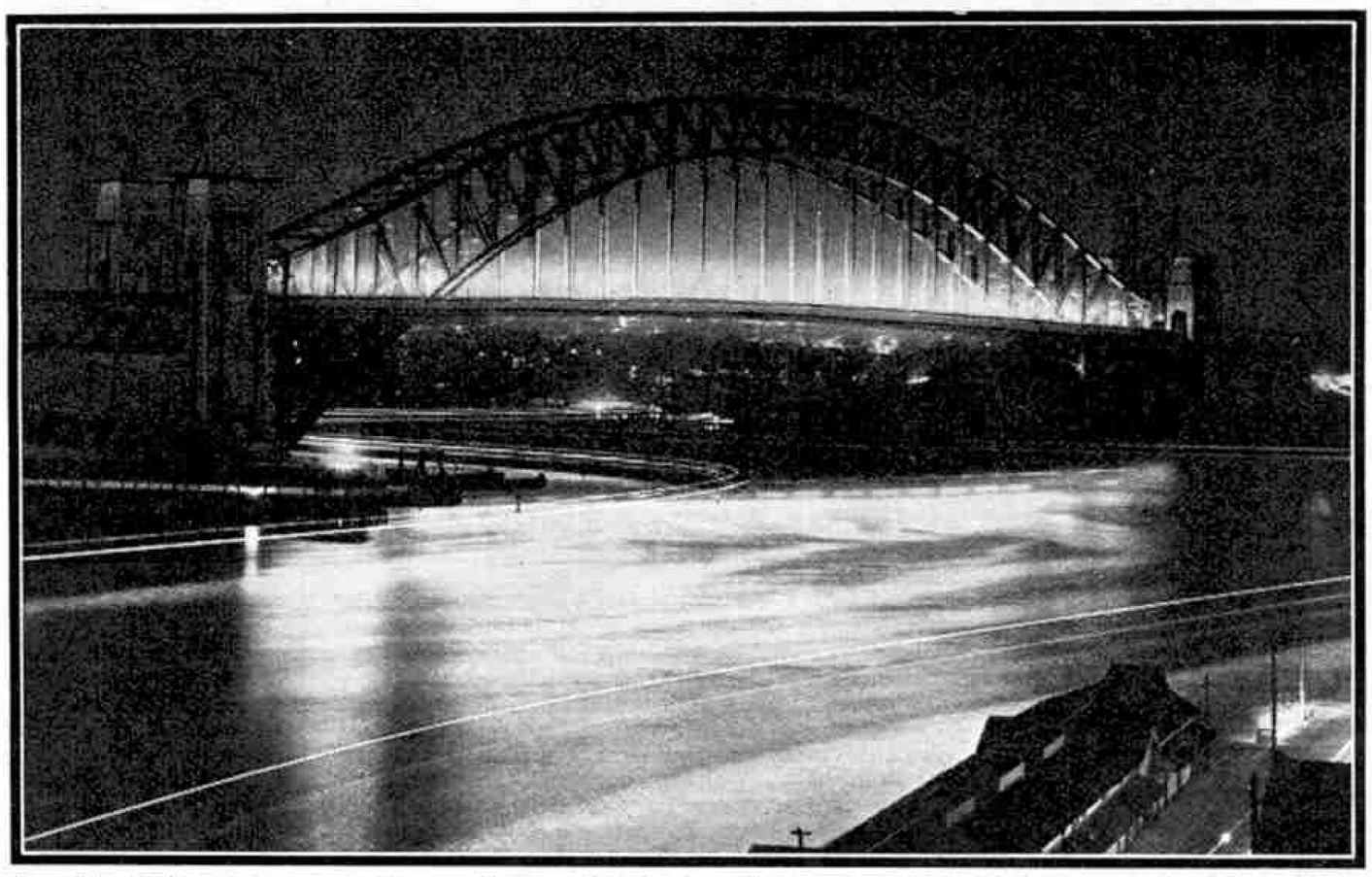
A New Motor Yacht

Work has been completed on a twin-screw motor yacht, the *"Trenora,"* built by John I. Thornycroft and Co. Ltd. This vessel is of interest in being the largest yacht built in this country for some years. In her construction seaworthiness has been the primary consideration, and the hull is specially designed to give a wide range of stability, combined with easy motion in a seaway. The propelling machinery consists of two sets of two-stroke cycle, airless-injection Atlas Diesel engines, each developing 870 b.h.p. at 250 r.p.m. In order to ensure silent running double silencers are fitted to the main engines, and the auxiliary machinery is also silenced.

The *"Trenora's"* dimensions are overall length 210 ft., length between perpendiculars 199 ft. 3 in., moulded breadth 30 ft. 3 in., and moulded depth 15 ft. 9 in. She has a displacement of 821 tons, and a designed maximum speed when fully loaded of 15¼ knots. When steaming at 12½ knots she has a cruising radius of 7,000 nautical miles.

Straight Tunnel Nearly A Mile in Length

The recently completed Wawona Tunnel in America is 4,233 ft. in length and is absolutely straight over the whole distance. It is cut through solid granite, and carries a 24 ft. roadway and a 3 ft. pathway. The new tunnel gives easy access to the Yosemite Valley.



The floodlighting of Sydney Harbour Bridge after dark on the opening day, 19th March, 1932. The bridge was turned into a huge cabaret and dance floor during the celebrations.

The Proposed Gibraltar Tunnel

The preliminary surveys of the proposed tunnel connecting Spain and Spanish Morocco under the Strait of Gibraltar are expected to be completed by the end of this year. If they show that geological conditions are favourable for the construction of such a tunnel, it is hoped to form an international construction company, in which British, French and Spanish interests will be united. The work will not be commenced, however, until the promoters are certain that various African railway projects are also to be carried out. The most important of these is the construction of a railway along the west coast of Africa, through French Morocco and Rio del Ora to Dakar. Another route suggested is across the Sahara Desert. This would be connected with railway systems in the Belgian Congo, and eventually with the railway to the Cape, making it possible for a journey from Calais to the Cape to be carried out entirely by railway.

The route being surveyed starts at a point five miles west of Tarifa in Spain and goes to Cale Hermosa in Spanish Morocco, about 20 miles away. Actually two tunnels would be driven and the maximum depth below water level that they would reach would be 1,215 ft.

Electric Clock Without Hands

A clock that has been installed on the Eiffel Tower in Paris, and which is operated by electricity, has two dials each more than 60 ft. in diameter, but is not provided with any hands. Each of the dials has a number of rows of electric lamps radiating from the centre and these rows are switched on one after the other, thus indicating the time. The place of the minute hand is taken up by 60 radial rows of red lamps, while the hours are shown by 24 rows of blue-white lamps. These rows are shorter than those used to tell the minutes, and there is no danger of any confusion arising. The hour indicators have to be stepped up at half-hourly intervals in order to make the hour quite clear. The time may be seen equally well by day and night.

Ship's Log Like Motor Car Speedometer

The new United States Lines cabin liner "*Washington*," the largest steamer ever built in America, is the only merchant ship on the Atlantic fitted with a pitometer log for accurately measuring speed and distance. This type of log is the marine counterpart of a motor car speedometer, and it is intended to supersede the device of logging by means of a line trailed from the stern of the ship and carrying a miniature propeller whose revolutions register the distance covered, on a dial fastened to the taffrail.

The new type of log consists of a special rod extending through a valve, about 2 ft. below the keel of the ship. There are two openings at the tip of the rod, one pointing forward and the other down. When the ship is in motion there is an increased pressure on the forward orifice. This pressure is carried through flexible tubing to a mercury manometer or "U" tube, where it forces the mercury down on one side and up on the other into a float chamber that operates a rack and gear, thus registering speed in knots on the dial of the master instrument. Distance is obtained on the master dial by means of a mechanical integrator and a simple cam arrangement.

Several repeaters may be operated electrically from the master instrument so that readings of both the speed and distance travelled may be taken simultaneously on the bridge and in the charthouse, engine room, and any other part of the ship.

The instrument as tested on the "*Washington*" has shown a remarkable degree of accuracy and dependability. Many variations of wind and sea were encountered on the maiden voyage of the vessel, but the Captain states that the log indicated the true speed of the ship through the water at all times. The log distance reading of the course followed, after allowing for known ocean currents, was 9,797.9 miles against an actual chart distance of 9,797. It is claimed that such accuracy has never been attained before by any other type of patent log.

Excavating Rock by Bombing

For the foundation for the San Francisco pier of the Golden Gate Bridge, now being built between San Francisco and Marin County, in the United States, it will be necessary to remove, by blasting and dredging, about 30,000 cu. yd. of rock that is 100 ft. below water level. The method followed consists of dropping a small bomb, fastened to the end of a 20-ft. length of steel, down a steel pipe 14 in. in diameter that is lowered from a barge until its end is within 10 ft. of the bottom. This bomb makes a hole about 15 ft. in depth and then a larger bomb consisting of 250 lb. of high explosive is dropped down the pipe and is detonated. The holes are spaced at intervals of 20 ft. and the rock that is loosened by the discharges is removed by dredgers specially designed for the work.

Large British Electric Excavator

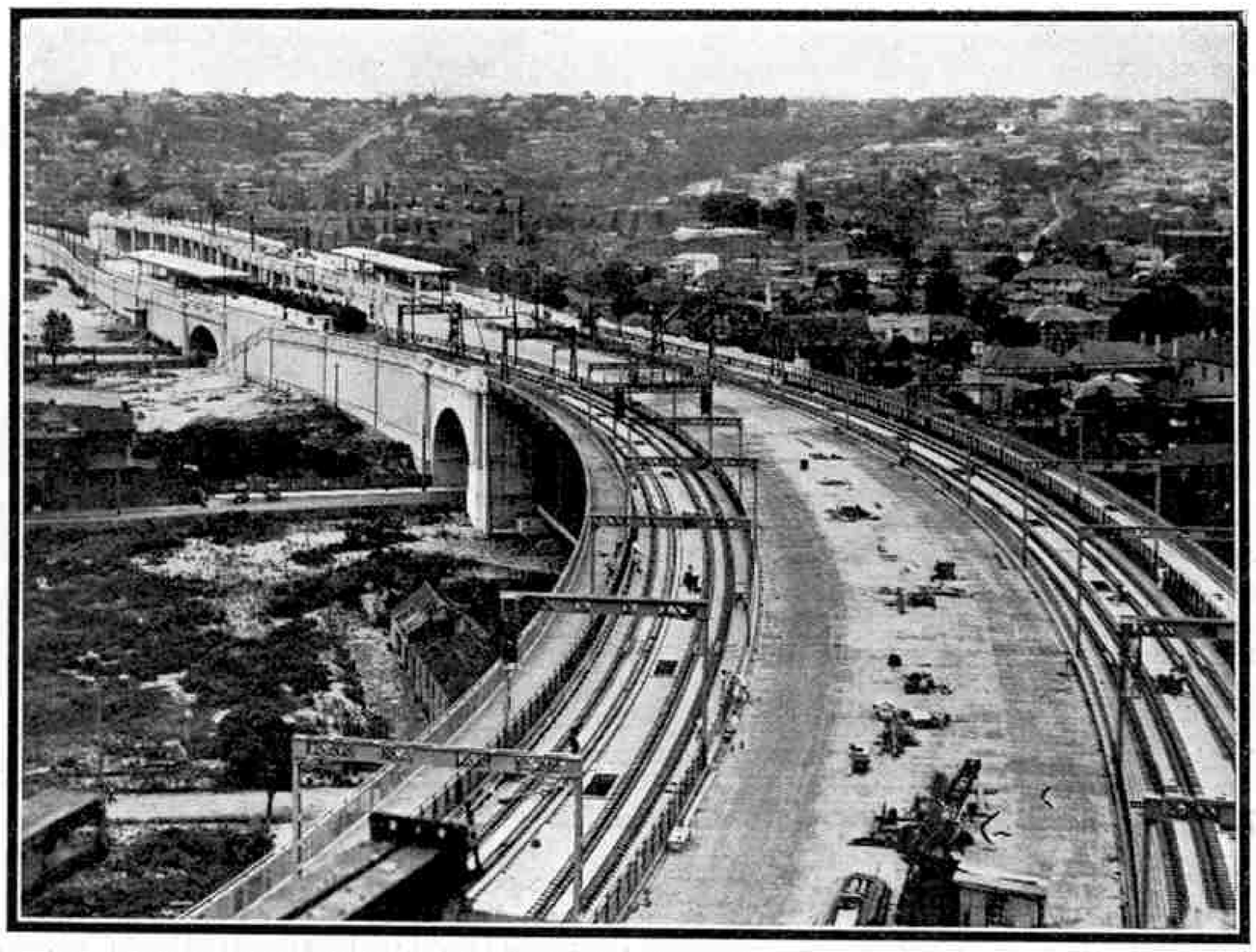
The latest Ruston-Bucyrus electric excavator is of the full revolving type and has a bucket with a capacity of 81 cu. ft. It is provided with variable voltage direct current control and has been specially designed for work in mines and quarries. The shovel swings very fast and has a high rate of output. The base of the machine is a single steel casting, but the revolving frame is built up in two parts, the front consisting of a heavy steel casting to constitute a rigid base for the machinery, while the rear section is a fabricated structure carrying the motor generator set. The boom is of the box girder type, as this has been found to be the lightest and strongest shape suitable for the work.

The bucket, which is of a special shape that has been developed by Ruston-Bucyrus for rock work, is made in two parts, the front being of manganese steel and the back of cast steel. Three separate direct current motors are provided to operate the digging, swinging and thrusting motions, while the speed and the torque of these motors is controlled by varying the field current of the generators. This method of control makes it unnecessary for brakes and clutches to be provided for the operation cycle. The excavator is mounted on caterpillar tracks.

The Institute of Marine Engineers

All boys who are training to become marine engineers should become student members of the Institute of Marine Engineers. Since the Royal Charter was granted to the Institute in March last, an important alteration with regard to exempting examinations has been made in the regulations governing the admission of students. A detailed syllabus of the Student examination has now been issued with particulars of examinations open to candidates possessing certain qualifications.

The next examination will be held in May 1934 at various centres. Full particulars may be obtained, on mention of the "*Meccano Magazine*," from the Secretary, The Institute of Marine Engineers, The Minories, London, E.C.3.



The Southern approach to the Sydney Harbour Bridge. The photograph gives a good idea of the great width of the approach.

Interesting Electric Clock at Oxford

An electrically operated clock that has been put into service at Merton College, Oxford, in place of a weight-driven clock, is installed in the porter's lodge, and operates a 5 ft. dial in the quadrangle of the College, and also sounds the hours and quarters on a ring of bells in the tower, a considerable distance away from the dial. The hands of the dial are driven by a step-by-step impulse mechanism, while the chiming and striking of the hours and quarters is done by a special motor-driven mechanism installed in the belfry of the tower. The master clock in the porter's lodge is of the standard half-minute impulse type. This installation is the first of its kind in Oxford University.

Huge New Reservoir for Yorkshire

A large new reservoir capable of storing 220,000,000 gallons of water has been completed in Yorkshire at Ryburn, near Sowerby Bridge, to provide water for the city of Wakefield. The dam is of the curved concrete type and is 100 ft. in height and 600 ft. in width, narrowing downward to 87 ft. at the base, owing to the shape of the valley that it blocks. So far the whole scheme, including the construction of a pipeline to Wakefield, which is 23 miles in length, has cost between £500,000 and £600,000, but the complete scheme will eventually cost a total of £960,000, for another reservoir is to be built higher up the valley.

A Giant French Dredger

A new dredger, named the "*Pas de Calais II*," recently launched in France, is claimed to be the largest dredger in the world. It is 190 ft. in length between perpendiculars, and is equipped with two engines, each of which develops 1,040 h.p. When the dredger is at work one of these engines is disconnected from the propeller shaft and employed to drive the chain buckets. The dredger can raise about 2,354 cu. ft. of spoil in an hour.

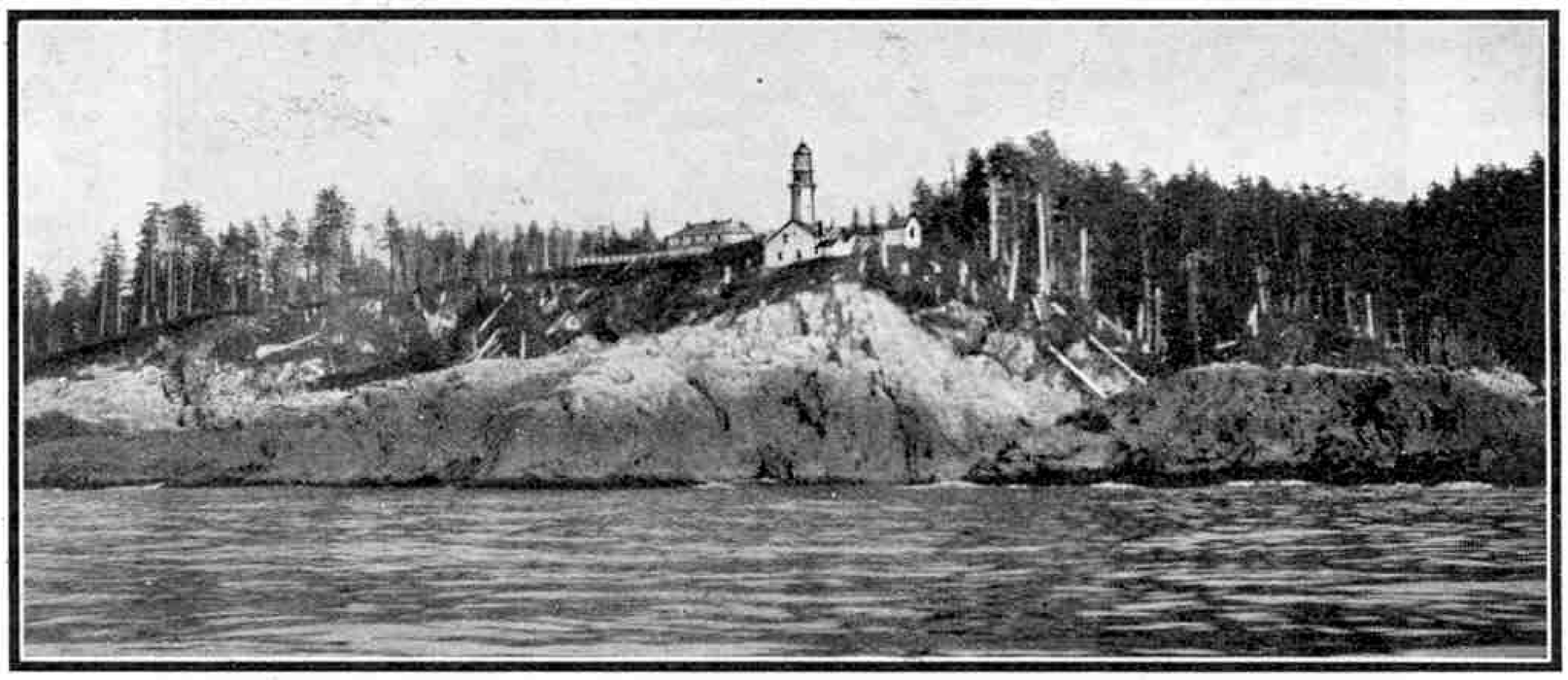
New Steel Furnaces at Sheffield

The English Steel Corporation Ltd., of Sheffield, now possess one of the most important installation of steel furnaces in England. This consists of three furnaces, each of the 60-ton type, and eventually a fourth is to be constructed. They have been erected in place of 12 old furnaces, and are capable of producing not only large quantities of steel of what is known as "rail quality," but also steels for special purposes, such as for the construction of boiler drums intended for work at very high temperatures. The furnaces are of the open hearth type, and each is provided with its own chimney stack. In each case the melting chamber is 7 ft. 9 in. in height from the bottom of the bath to the centre of the crown, while the bath is 28 ft. in length and 12 ft. in breadth. The complete plant is capable of producing ingots weighing up to 250 tons.

Story of the Queen Charlotte Islands

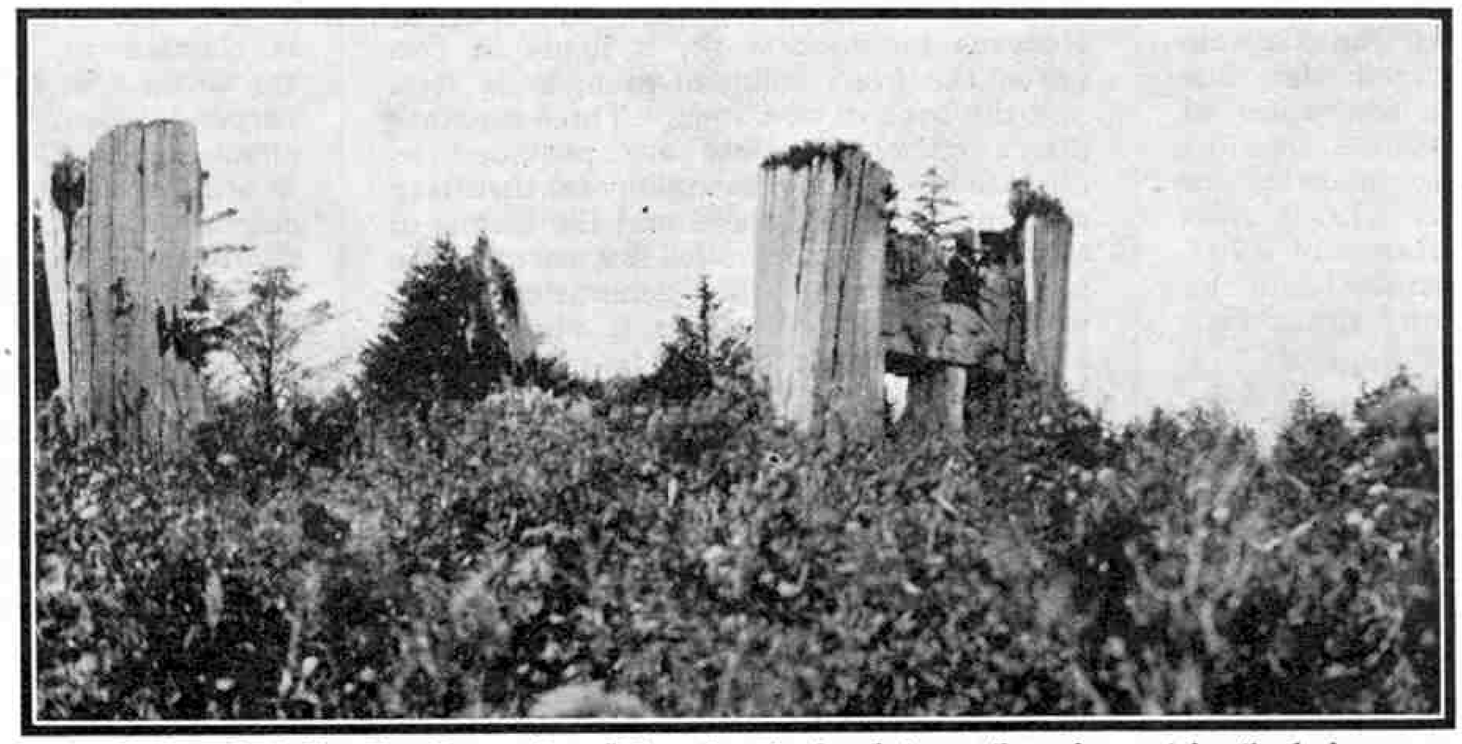
The Haida Indians and their Ways

OFF the coast of British Columbia, between north latitudes 52 deg. and 54 deg., and approximately 80 miles to the west, lie the Queen Charlotte Islands, a portion of a ridge thrown up from the bed of the sea when the Earth was young and continents were being shaped by the irresistible forces of Nature. The ridge extends north-west from the Straits of Juan de Fuca, emerging above the surface of the sea as Vancouver Island, as the Queen Charlotte Islands, and again as Prince of Wales Island, before it greets the mainland in South Alaska. To those untravelled along the western coast of Canada the Queen Charlotte Islands are still a land of mystery, and for those who are interested in Indian lore there is even romance to be found. The early Indian inhabitants were a source of terror to other tribes up and down the mainland, and legend and history tell of many fierce slave raids and retaliations.



The lighthouse on Langara Island, of the Queen Charlotte group, the most westerly point of Canada.

The group comprises some 200 islands, the two largest being Graham to the north, 84 miles long, and Moresby, 70 miles long, the two being separated by Skidegate Channel. Considering the high latitude of 53 deg. north, the climate, influenced by warm currents flowing from both Japan and the coast of California, is remarkably mild, snow seldom lying for any length of time in winter, and frosts being very light. The average annual rainfall of 57 in. is less than that on the mainland opposite. A few of the highest peaks are covered with snow all the year round, but the islands as a whole do not reach any great elevation, and are fairly level as compared with the adjacent mainland shores, which rise steeply out of the water to a height of 3,000 or 4,000 ft. within a mile. The coastline is much indented, the great inlets that penetrate the islands for miles being reminiscent of the fjords of Norway. Massett Inlet, dotted with many picturesque islands, is the most extensive, being 17 miles long and 6 miles across at its widest part. Great forests of spruce, cedar and hemlock clothe the bordering hillsides.



Mortuary poles on Yan Reserve, near Massett. The box between the poles contains the body.

The earliest knowledge of these islands appears to have been acquired in 1640, when Bartholomew de Fonte, at the direction of the Court of Spain, sailed from Callao, Peru, in command of a squadron of ships. Setting his course northward along the Pacific, he arrived at what he called the Archipelago of St. Lazarus in 53 deg. north latitude. In 1774 the islands were visited by Ensign Juan Perez on a trading and exploring expedition from San Blas, and apparently he was the first to sail as far as North Island. Other Spanish expeditions followed, but the geographical details obtained were carefully concealed by those in authority, and so the world at large received no direct benefit.

The next visitors were from Bombay, in the persons of Lowrie and Guise, masters of the good ships "*Cook*" and "*Enterprise*" who, on a trading expedition for furs, reached the islands in 1786. In 1788 Captain Dixon, commanding the ship "*Queen Charlotte*," spent the month of July in trading up and down the west coast, and he it was who gave to the islands the name they still bear. His reports give much interesting information in regard to the natives, and even up to as late as 1907, when H.M.S. "*Egeria*" surveyed the coast, his maps were in use. In 1853 the Hudson Bay Company opened a trading post at Massett, and since then charts and soundings in the surrounding waters have been made from time to time by Government ships.

The native inhabitants of these islands are perhaps the most interesting and picturesque of all aborigines up and down the west coast of Canada. They call themselves "Ou Haade," meaning the "Inlet People," and formerly were the most warlike and feared folk along the coast. When first seen by the early navigators they were tens of thousands strong, gathered into 39 clans, each living in its own village under its own chief. With the passing of the years their numbers have become sadly reduced, and their history during the past 140 years would seem to provide another instance of the impossibility of the North American aborigine surviving contact with white civilisation. Nevertheless they seem more adapted than other Indian tribes to adopt the white man's ways, showing a willingness and ability to work far beyond that of other coast Indians, and displaying both intelligence

and a desire to learn. They are a virile and industrious tribe and, contrary to the hopeless future it is the fashion to predict for the American aborigine, we believe they possess the qualities necessary for the making of good citizens, and that they will establish themselves as a valuable entity in Canadian life. Their language is exceedingly difficult for a white man to learn, and it contains more words than other Indian languages.

The men and women both are well built, some being fully 6 ft. in height. With little resemblance to other British Columbian Indians, they have broad faces with protruding cheek bones, and their eyes take on a Mongolian slant. They are generally of a dark copper colour, and black hair, ruddy cheeks and brown hair are not unknown. While they all now wear white man's clothes, before the advent of Europeans they wore garments made from the inner bark of cedar trees and spruce tree roots, and great quantities of beads were worn around the neck by both sexes as charms.

A group of sea lions, which abound along the coast.

The Haidas of old were entirely honest, and to-day they are generally so. Property left with them is kept safely, and in days gone by visitors have been known to leave large sums of money with them, and to receive it back intact perhaps a year later. They still live in tribes, each having a head chief and three or four minor chiefs.

Each house formerly had a "Gi-hang" or totem pole erected in front of it. Some of these were 60 ft. high and 5 ft. wide, the greater the person owning the house the greater being the pole erected. These Gi-hangs are in fact the family tree, and have carved on top the owner's crest, which might be a raven, eagle, bear, frog, whale, or other denizen of forest or sea. The space below is occupied by carvings showing the owner's pedigree and that of his wife. Many of these totem poles are still standing, but the custom of carving and erecting them has died out. Half-a-century ago a veritable forest of totem poles stood in villages such as Massett, but few are now left, and it is hoped that they will not all finally disappear into museums and private collections.

Typical Haida houses were about 100 ft. long and 75 ft. wide. They were built to last, being substantially constructed of cedar boards hewn with stone axes and adzes, and some are 100 years old. They were low in height, and each was a home for several families.

One custom the Haidas had in common with all coast Indian tribes was that of making a "potlatch," this being a Chinook word meaning "to give away." A potlatch made by an ordinary Indian was confined to his own village, but when a chief made one, people from surrounding villages were invited. At these potlatches the maker gave all his property away to those attending; furs, blankets, cooking utensils, and everything else went. When a great potlatch took place, a feast was held a few days before the property was distributed, followed by a wild dance around the camp fire, during which many would collapse from sheer frenzy and excitement. Potlatches have been forbidden by the Government for some years, because they were a source of impoverishment to many of the Indians.

Their dead were placed in cedar boxes that were erected on two posts in the vicinity of the village. The writer has viewed some of these boxes still remaining, and seen the bones of their former occupants scattered on the ground below. Sometimes the coffins were simply placed on the ground one on top of the other. Prisoners taken in battle were kept as slaves, and it is only during the last half century that slavery has been finally stamped out by the authorities.

A totem pole on the Massett Reserve.

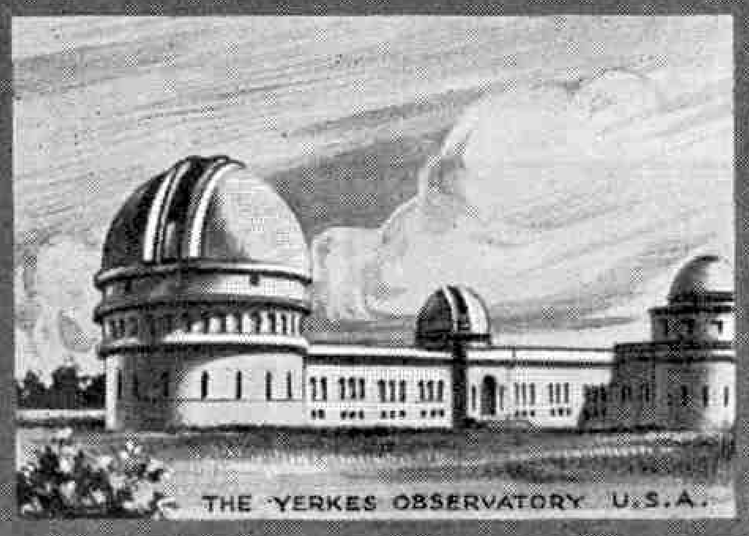
Fifty years ago axes, knives, adzes, and other tools were made of stone, knives sometimes being made of hardwood. Pottery-making was unknown among the early Haidas, utensils being hewn out of wood, and spoons fashioned from the antlers of caribou, goat or deer. As wooden vessels could not be placed on a fire, cooking was done by dropping hot stones into the water they held until it boiled, this being continued until the fish or meat was cooked. They hewed their canoes from cedar logs, making them from 12 ft. long for an ordinary canoe to 70 ft. for a war canoe. They were the best makers of canoes along the coast, and the most adept in the use of them.

The Queen Charlotte Islands are about 30 miles from the nearest mainland islands, with a strong current running through the Hecate Straits between; and therefore it would be impossible for animals to swim from the mainland. Consequently the animals found on the islands must be descendants of those that reached there at a period before the geological changes took place that were responsible for the present configuration of the land. Deer, black bear, caribou, otter, weasel, and martin are all to be found, but the furs they yield are rated as seconds on account of the lack of cold weather. The fur seal was formerly found in abundance, but the ruthlessness with which it was hunted has rendered it practically extinct around the islands for 20 years or more. The same applies to the sea otter, which also is of value for its pelt. Sea lions are plentiful, however, and abound particularly on the west coast of the islands.

When salmon run in the Spring they sometimes dispute the ownership of fish caught on a line, and they can be dangerous enough to upset a boat. They have been caught up to 2,000 lb. in weight. The islands, indeed, are a paradise for fishermen. In addition to salmon, cod, halibut, and many other species abound, and are the main foods on which the Indians subsist. The hair seal is a common sight in the harbours, and is a great fisher. Most species of whale are found in the vicinity, including sperm, humpback, sulphur bottom, and that terror of the deep, the killer whale. Whaling stations operate on the islands, one at Nadan Harbour and one at Rose Harbour, and during the season each station may catch as many as 150 whales.

The Queen Charlotte Islands still retain the charm of primitiveness that is so rapidly disappearing in other lands before the advance of white civilisation, but some day, no doubt, they also will yield to the so-called advantages of the modern world. They are attractive because of their wealth of natural resources in sea, river and forest, and their favourable geographical position marks them out for development.

For information and some of the illustrations contained in this article we are indebted to the courtesy of the Indian Agent at Massett, British Columbia, and for other illustrations to the Director of the Provincial Museum, Victoria, B.C.



OUR WONDERFUL WORLD

How Long is a Yard?

In its younger days the yard was the length made by placing 108 barleycorns end to end. In 1844 it became the Imperial Standard Yard, the distance between two parallel lines scratched in gold studs embedded in a bar of bronze that for safety is walled up in the Houses of Parliament. It is now about to undergo a further change, and in future probably will be a length 1,422,210.82 times that of the waves in the ether that constitute a particular form of red light.

These changes have been made solely in the interests of accuracy. All barleycorns are not of the same length, and the yards formed by selecting 108 of these would show remarkable variations. The Imperial Standard Yard walled up in the Houses of Parliament is much more satisfactory, but the scratches in the gold studs are too wide to enable the length to be measured with the accuracy now required. In addition, the bar itself has come under suspicion, for a copy of it made recently is now a thousandth of an inch longer than the original standard, and it is believed that owing to mysterious crystallisations and other changes, the original bar is now two thousandths of an inch less than when it was made.

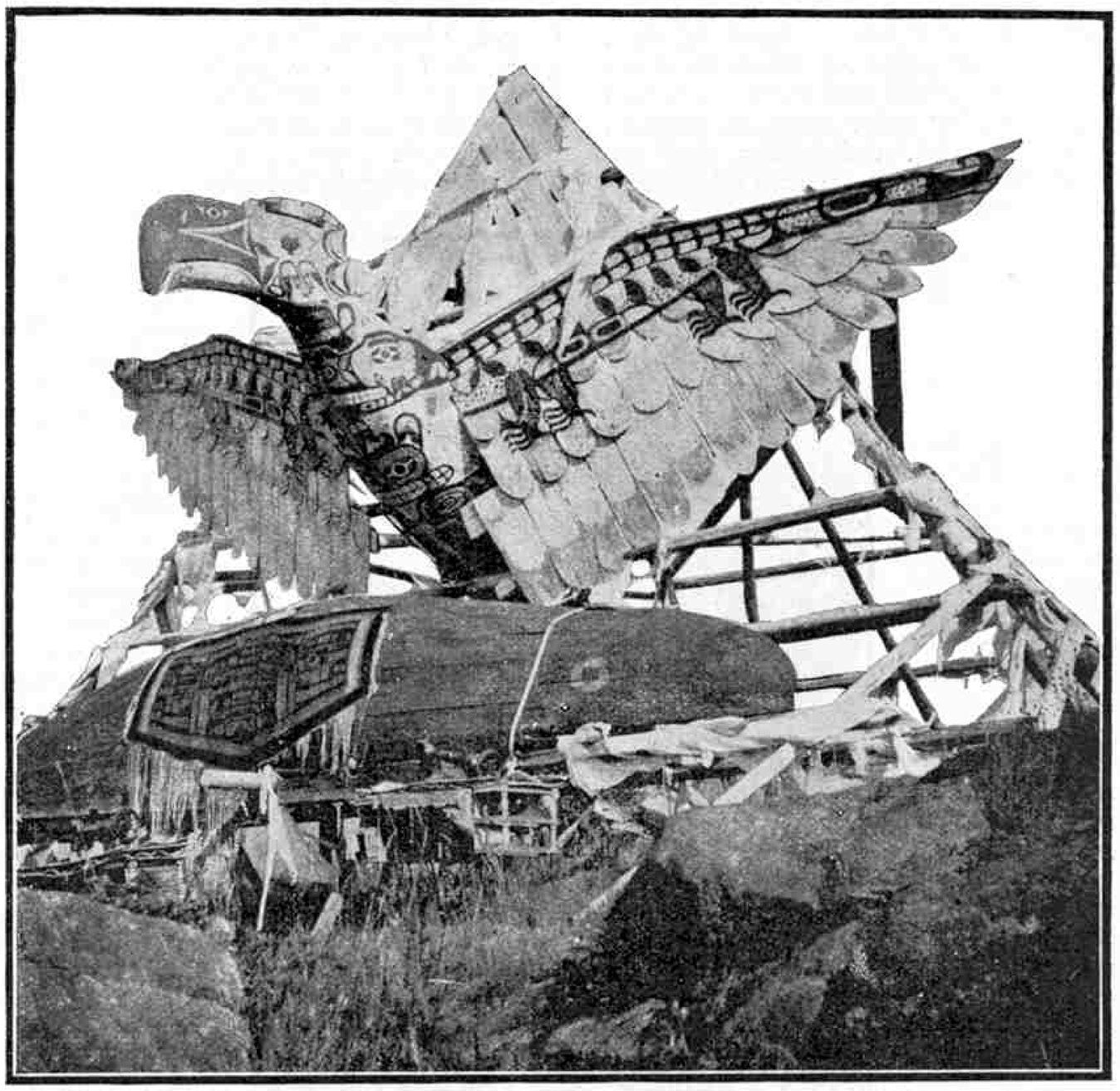
The wavelength of light is a more reliable standard of length than a bronze bar can be, and the red light given out when the metal cadmium or one of its compounds is strongly heated has been chosen for this purpose. After eight years' work, scientists in the National Physical Laboratory at Teddington have devised means of measuring the wavelength of this red light with almost perfect accuracy, and their instruments can be used for comparison of this standard length with the commercial gauges.

The origin of the light emitted from glowing cadmium is to be found in the vibrations of the electrons within the atoms of the metal. Thus our standards of length can be checked by means of particles that are far too small to be seen.

Millions of Molecules in So-called Vacuum

A real vacuum, or empty space, is unattainable by human means. Probably the nearest approach to it yet achieved was the interior of a glass globe, 5 in. in diameter, from which as much air as possible had been removed by means of special plant installed by the General Electric Company of New York. Yet at the end of prolonged operations, this globe contained no fewer than 370 million molecules of the gases that are present in the atmosphere! These particles are so small that they had ample room in which to move about and to bombard the walls of their container, and they exerted a pressure of about one-hundred millionth of that of the atmosphere.

The globe was employed in christening a new aeroplane, and when it was broken over the bow of the machine, the inrush of air after its collapse was accompanied by a loud noise, similar to that often noticed when an electric light bulb is broken.



A striking example of carving and decoration by Haida Indians of the Queen Charlotte Islands, whose quaint customs are described in the article that appears on page 834.

A Whale Mystery Solved

Divers and others who work in air at high pressure are liable to collapse if they return too quickly to normal conditions, for nitrogen driven by pressure into solution in the blood is then released in their veins in the form of bubbles that cause great pain and discomfort. Yet a whale can dive deeply and rise again rapidly to the surface of the ocean without suffering any ill effects. The secret of the creature's immunity from trouble of this kind has recently been revealed. The nitrogen that is forced under pressure into its blood when it dives is almost immediately absorbed by bacteria that transform it into a harmless compound. Thus practically no nitrogen remains to be released when the whale returns to the surface, for the quantity of gas left unattacked by the bacteria in its blood stream is insufficient to cause disturbance.

Bringing the Moon Within 25 Miles

Looking at the Moon through the 200-in. telescope now being erected at Pasadena, California, will be equivalent to examining our satellite with the naked eye at a distance of 25 miles from its surface. Objects 30 ft. apart could then be distinguished, and there would be no difficulty in tracing the street lights of a modern city, if its buildings were by some means transported bodily to the Moon.

About 560,000,000 stars can be detected with the aid of the 100-in. instrument at Mount Wilson, at present the largest telescope in the world, but the introduction of the new telescope is expected to increase this number to about 1,500,000,000. How many new stars actually will be seen is mere guesswork, of course, but the range of celestial objects visible will certainly be increased to an enormous extent, and astronomers will be able to explore regions of space that at present are unknown. The camera will be a wonderful help, for the depth of the image on a photographic plate increases with the time of exposure, and thus stars too faint to be directly visible can be detected.

Wood Made Transparent

Cellophane, the familiar moisture-proof wrapping that is used to protect an enormous range of materials, from confectionery to cigarettes, has been described as wood made transparent, because it is made from wood pulp. It is prepared by a process resembling the manufacture of artificial silk, but is cast in sheets instead of being spun into fine threads.

Cellophane was discovered by J. E. Brandenberger, a French chemist, who more than 30 years ago tried to make cotton tablecloths dirt-proof by coating them with a thin film of cellulose, the complex chemical that forms the basis of wood. He was unsuccessful, but his experiments showed him how to make thin sheets of cellophane, which were used first for wrapping expensive perfumes and chocolates, and later for the eyepieces of gas masks during the War.

The original product was not moisture-proof, but a few years ago a cellophane that is impervious to water vapour was produced, after more than 2,000 experiments, and the result was a great expansion for the demand for cellophane wrappings. Cellophane has been used also for making cinematograph films, and its decorative value has been turned to good account in the manufacture of fancy goods of all kinds.

Waterfalls Greater Than Niagara

In prehistoric ages there were American waterfalls that greatly surpassed Niagara. Two of these were in the Grand Coulee, an immense gorge in the mountainous region near Seattle, in the north-west of the United States. No water now runs through the Grand Coulee, but the geologist has traced in it the courses of gigantic glaciers of past ages that once clothed its sides. The lower ends of these glaciers melted into streams that plunged over precipitous rocks to form two remarkable cataracts. One fall was about 900 ft. in height, or six times the height of Niagara Falls, and was more than a mile in width.

Dispersing Clouds by Electricity

A Russian engineer plans to keep Moscow free from snow by surrounding the city with balloons from which high-pressure electrical radiations are transmitted through the atmosphere in order to break up and drive away clouds.

The scheme is part of a series of experiments on weather control to be carried out by an Institute of Artificial Rain established by the Soviet Government. In the laboratories of this Institute experiments on the artificial creation of clouds and their dispersal by means of ultra-violet rays and electrical radiations are being carried out, and it is hoped to find means of clearing the air of fog, and even of diverting rain to regions where drought threatens.

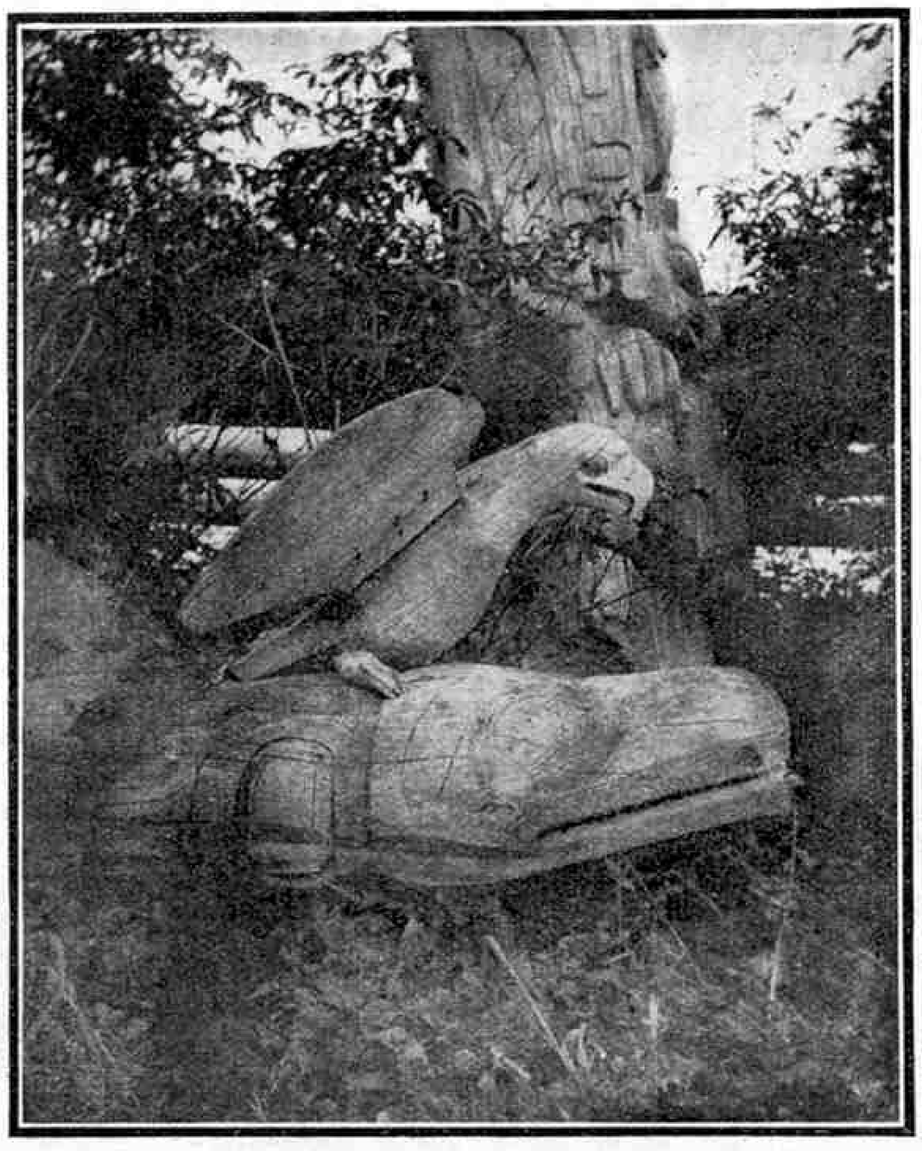
* * * *

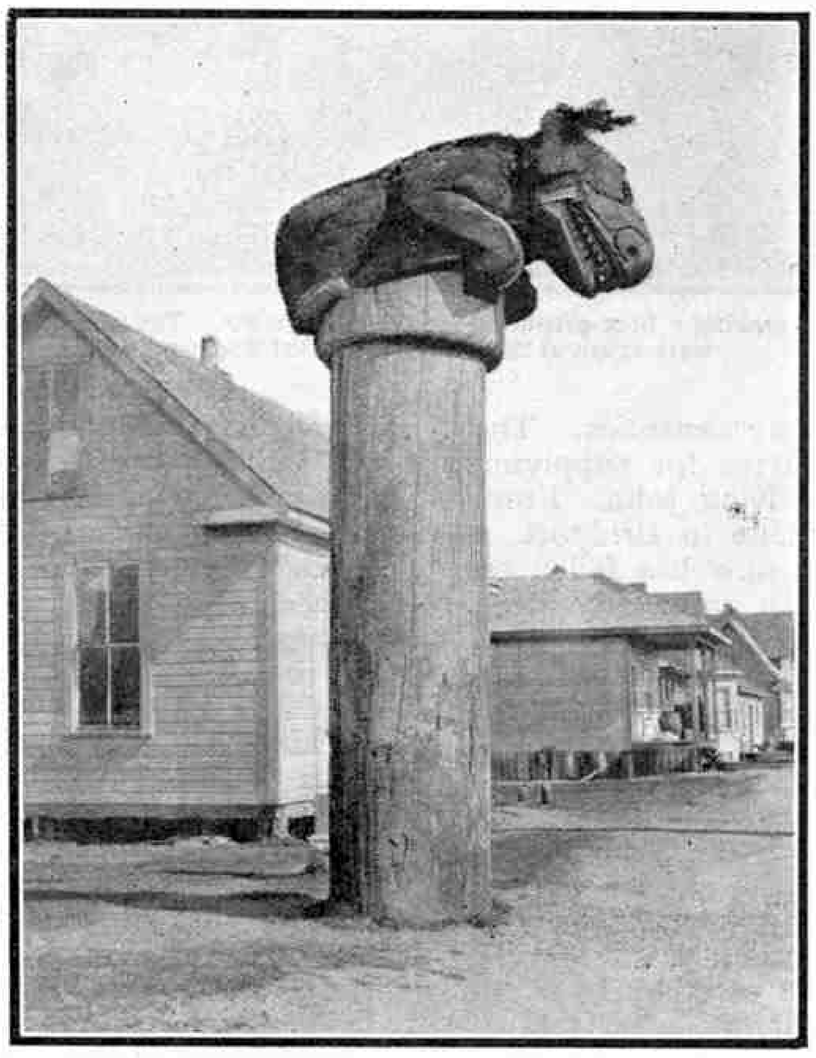
A large sponge from the Gulf of Mexico examined recently was found to house 17,128 uninvited lodgers. These included worms and barnacles, tiny fishes slim enough to slip through the canals of the sponge, and no fewer than 16,352 miniature shrimps, some of which had one of their two claws nearly as large as their bodies.

Wireless Waves Kill Weevils

Wireless waves are now being used to kill weevils and other pests that devour valuable grains and seeds. The waves employed for this purpose in trials carried out in the United States are 7 m. in length and are generated by a 20 KW oscillator. The seeds are treated as they flow through a glass chute, and the shock exterminates the tiny destructive creatures that have made their homes among them.

Wheat, maize, nuts, beans, peas, and flower and vegetable seeds have been cleared of worms, mites and other infestations by this means, and are not injuriously affected by the waves employed.





This illustration and the one below show typical "Gi-hangs," or totem poles, of the Haida Indians. See page 834.

Showers of Fishes and Reptiles

Showers of fishes, frogs, toads, insects and other astonishing things are by no means uncommon in the United States. There was a shower of frogs and toads in Kansas in 1919, and more recently hundreds of small fishes were scattered from the skies over a golf course in Florida, apparently having been whirled into the air by a waterspout in the Gulf of Mexico. An even more surprising shower of this kind occurred in South Carolina, where, after a local storm, hundreds of little fishes were found swimming in pools between rows of cotton plants. These creatures could only have been brought in such quantities by the water that fell as rain.

What was described as a rain of reptiles descended on one State, the unusual visitors in this case consisting of larvæ of a type of salamander; and a small turtle once fell to the ground during a severe hailstorm near the Lower Mississippi. The reptile was entirely encased in ice, having been long enough in the upper regions of the sky to be frozen. Perhaps the strangest of all strange showers was one of birds that occurred at Baton Rouge, Louisana, where hundreds of wild duck, woodpeckers and other birds fell dead in heaps. It is believed that they had been blown inland by a furious storm on the coast of Florida, and had died because of the sudden change in temperature to which they were subjected as a result of their involuntary flight.

Safety From Earthquakes in Railway Tunnels

Earthquakes severe enough to cause considerable damage on the surface of the Earth often are scarcely felt in tunnels bored immediately beneath the devastated areas. For instance, a shock that occurred in 1887 on the Mediterranean coast of Southern France was so weak in the tunnels of the railway between Nice and Geneva that its effects could not be traced there.

That there is safety in tunnels during earthquakes was shown even more strikingly in Japan in 1930, when a portion, about 4,000 yd. in length, of an uncompleted railway tunnel was moved nearly eight feet sideways by a gigantic earth movement. Except for a few cracks in the walls, the tunnel was not damaged, yet more than half the houses in a village immediately over it were destroyed.

Measuring instruments set up in the tunnel after this earthquake showed that the after-shocks also were much less intense underground than on the surface.

Canadian Orchard With One Tree

One of the most remarkable orchards in the world is to be found in Eastern Canada. In it 116 different kinds of apple and one type of pear are cultivated. About 47 of these varieties showed blossom in the spring of this year, and most of them set well, for about 40 distinct types of apple have been gathered in the orchard. Yet it consists of only one tree, for it has been formed by the careful grafting on a single original stock of scions, or branches, of apple trees of other varieties and of a pear tree.

The Story of Rope

One of the World's Oldest Industries

By Clifford R. Carter

THE cordage industry is an extremely ancient one, reaching far back into the twilight of antiquity. Possibly the first ropes of prehistoric times were the long vines of the forests; later they were made of the hides of animals. In order to obtain greater strength some early man twisted two or more strands together, and the art of rope-making was born.

Before Abraham left Ur of the Chaldees, rope-making was already an ancient craft. Ropes were used to bring about the fall of Troy, and it was with the aid of ropes made from palm fibres and papyrus that the great granite blocks were hauled to the pyramids of Egypt 5,000 years ago. Rome was built with the aid of rope, and the Romans used it in their stone-throwing catapults. For crossing streams the ancient Peruvians twisted together the strong fibres of maguey, forming ropes sometimes as large as a man's body. The Chinese made ropes of bamboo and flax, and perhaps also of twisted hide, at a very early period; and Egyptian records of still earlier date depict the process of rope-making showing the use of fibres of the date palm and the flax plant, both of which are still employed for the same purpose. There is an ancient inscription cut on a Theban tomb in the time of Thotmes III of Egypt, known as the Pharaoh of the Exodus, which shows the various processes of hand spinning and topping ropes, substantially as is practised to-day in some country rope-walks.

A preliminary stage in rope making; fibre-preparing machinery at work. The photographs illustrating this article were taken at the extensive Belfast Ropeworks.

Ropes have been made in England for many centuries. The town of Bridport in Dorset has held a charter for supplying cordage to the Royal Navy since the time of King John. From a very early period hangmen's ropes were made in Bridport, a branch of the trade that once flourished but now has fallen on evil days! The town's broad streets, with unusually deep sidewalks, still afford a sign of the past, for they tell of the days when men and women spun yarn before their doors and the amber and silver threads lay along the pavement. The ropes and canvas of Bridport rigged the fleet that scattered the Spanish Armada.

The staple fibre for ropes has long been hemp, but since the middle of the 19th century several other fibres have come largely into use. The world's best rope-making materials are manila and sisal, the former coming from the Philippine Islands and the latter from Yucatan in Mexico. The manila plant is very like the banana tree, and grows to a height of from 15 ft. to 25 ft. Its trunk is green, and is composed of fold after fold of leafy substance; and in it, like the strings in a stalk of celery, are the desirable fibres. When the fibre is ripe a Filipino gives the tree a slash with his knife and down it comes; the stalk is split open longitudinally, and the sheathing layers are removed. These fibrous coats are dried for two or three days in the shade, and are then scraped until only the fibre remains. About 90 per cent. of the plant is pulp or fluid, and it takes about five acres to produce one ton of fibre. Sisal fibre, which is second only to manila in strength, is obtained from the leaves of a cactus-like plant. These leaves, which are about 6 ft. long, are cut down every year after the plant is about four years old. Only the lower leaves are taken, and these are cut off by means of a sort of hatchet called a machete.

It is remarkable how Nature has limited the territory in which rope fibres grow, for when the plants are moved to other countries they almost always wither and die. A large proportion of the world's supply of rope fibre is thus dependent on two areas, the Philippine Islands and Mexico, where labour conditions are uncertain, for the tropical labourer will work only when the pangs of hunger cannot be satisfied by Nature's bounty.

Rope and twine-making as an industry is scattered all over the British Isles, but it flourishes most in seaport towns, where the greatest demand exists. Formerly it was a trade carried on in a small way by many manufacturers with the aid of a few primitive appliances. The typical rope-walk for spinning and rope and twine-making by hand, still to be found in many parts of the United Kingdom, is a very simple form of building, being little more than a long narrow shed of wood with a tarred felt roof. It is, in fact, just as Longfellow describes it:—

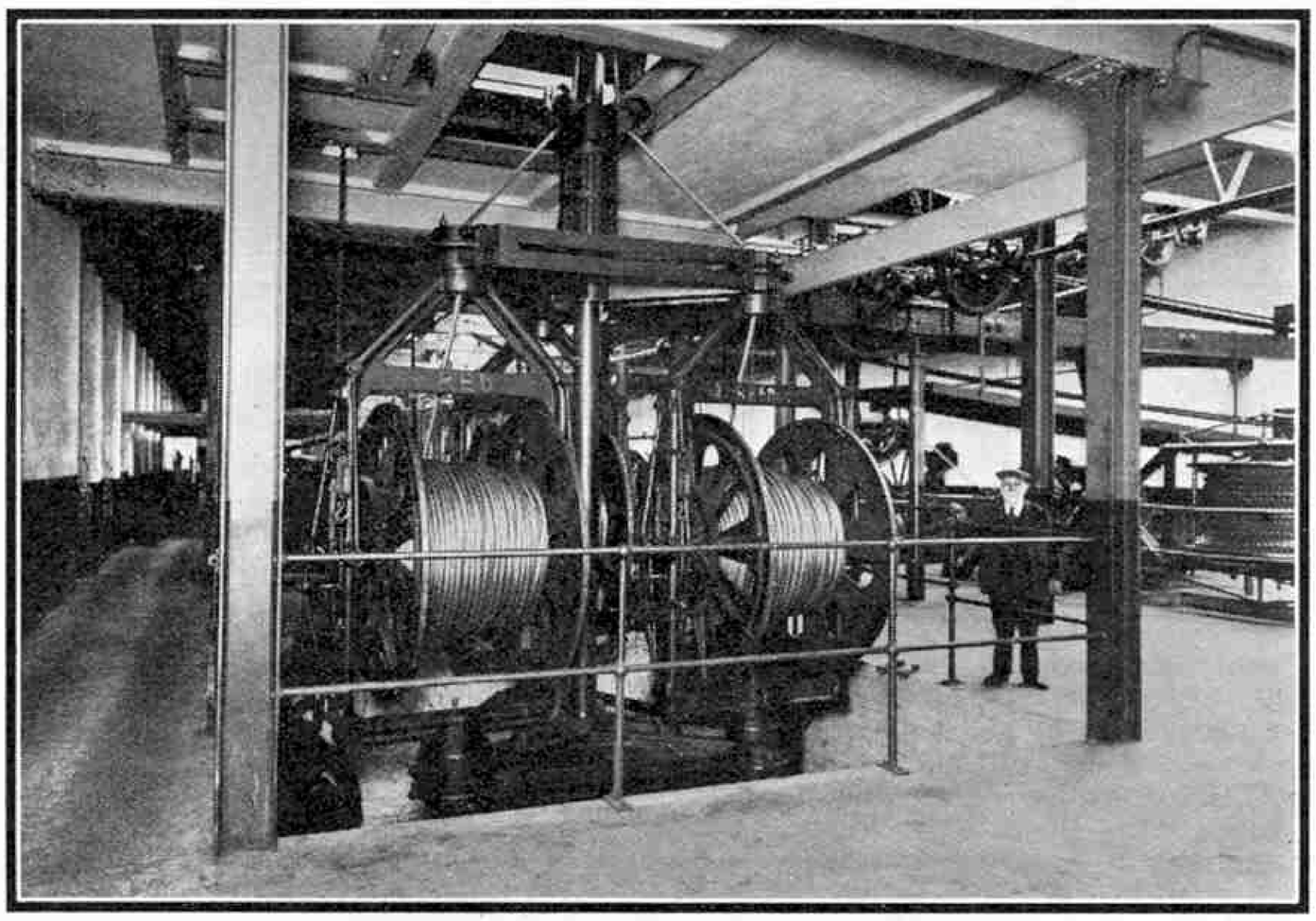
"In that building long and low,
With its windows all-a-row,
Like the port holes of a hulk,
Human spiders spin and spin,
Backward down their threads so thin,
Dropping each a hempen bulk."

In length the hand rope-walk should not be less than 900 ft., so that ropes of a minimum length of 120 fathoms (720 ft.) may be produced. The principal end of the walk is called the head or "fore-end," and the opposite extremity the foot or "back end." The machinery required by a hand spinner is a spinning wheel, that is set up at one end of the walk. A "bunch" or "head" of the hemp to be spun is first roughly hackled by hand by means of a coarse comb, and is then placed round the spinner's waist and loosely held there by a belt. The spinner then attaches a few fibres of this material to the hooks on the spinning machine, and as the wheel is turned the hooks revolve, twisting the fibres into yarns as they are automatically drawn from the bunch at his waist. He backs slowly down the walk, holding the yarns in his hand, and the size and uniformity of the yarns depend on his skill in regulating, through the motion of his hands, the quantity of fibre that is to be drawn and spun. Long experience enables the spinner to gauge the size of the yarn with his fore-finger and thumb, and to produce a succession of threads that do not vary in thickness to any appreciable extent. A good spinner can spin about 13,000 yds. of yarn in 10 hours, and from those yarns the rope is built.

Modern methods of rope-making are far superior to that just described. Nowadays rope-making is centred for the most part in factories equipped with machinery capable of superseding hand labour, and of treating material that the hand spinner could not deal with. Although rope-making consists merely of a series of combing and twisting processes, the machines used are intricate.

They date their origin back to Arkwright, Hargreaves, Crompton and Huddart, 18th century inventors who hitched up water power to their machines and precipitated the industrial revolution.

The following is a general outline of the process of up-to-date rope manufacture. The raw material arrives at the mill in bales, which are weighed, inspected, graded and put into store. Later they are carried into the preparing room, where they are opened by machinery. The fibre is then fed through various preparatory machines, known as breakers, spreaders and drawing frames, which clean and straighten the fibre with steel combs and make it into an endless ribbon or sliver, which is coiled in cans. These cans are wheeled on trucks to the spinning rooms. Here the sliver, reduced approximately to the size desired, passes into the spinner, which reduces it still more and converts it into an even yarn, twisting it into any required degree of tightness. This yarn is wound on bobbins which, when they are filled, are taken to the proper departments for converting into twine and rope.



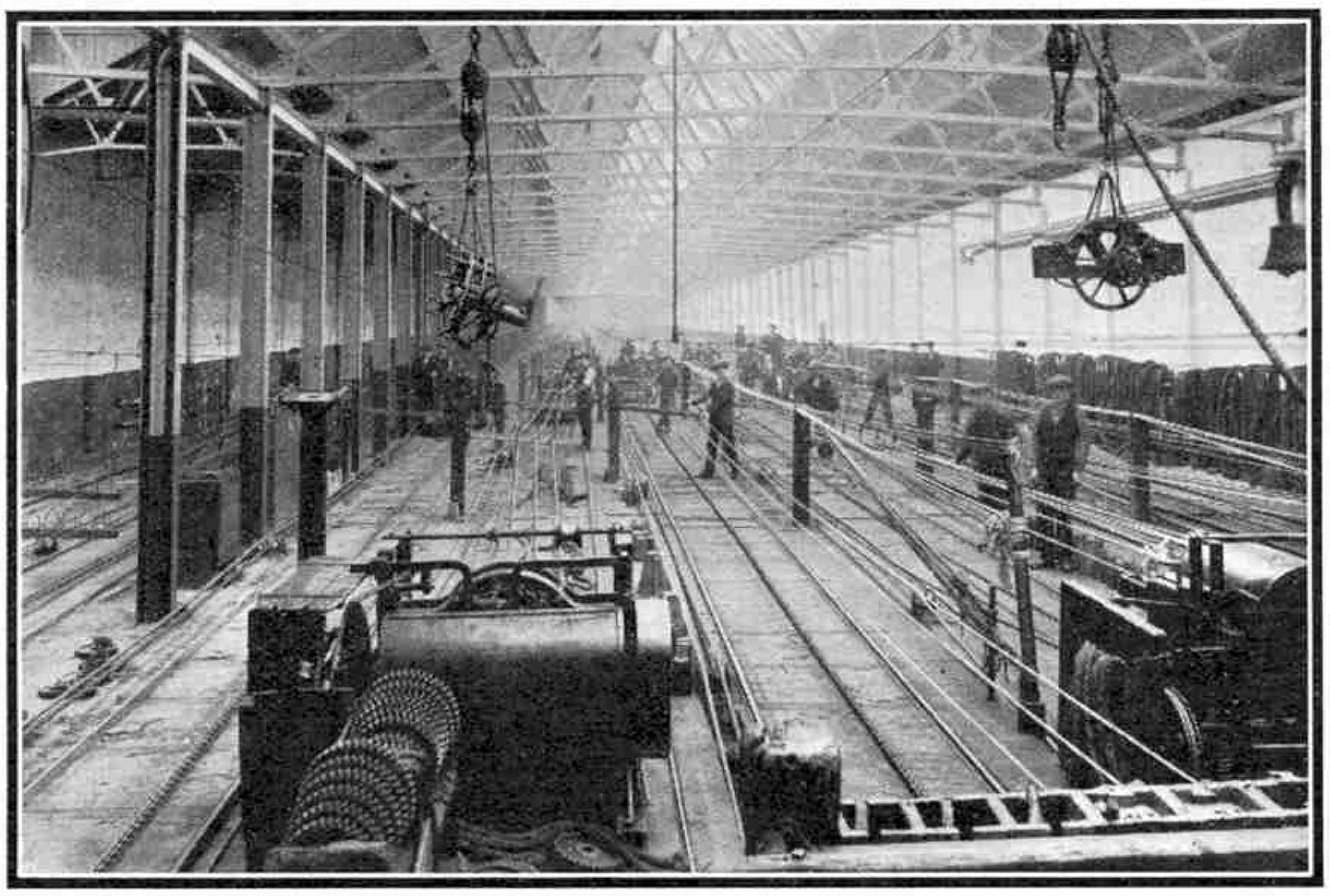
A large machine for "laying" the strands into rope.

The first processes of rope-making are known as "forming" and "laying," the names referring respectively to the twisting of the yarn into the strand, and the uniting of the strands to make rope. The second step is merely a repetition of the first, but on a larger scale. From bobbins on a frame, looking like big spools of thread, the yarns pass through perforated metal plates into a tube, where the mass receives a certain amount of compression and is twisted by the rotation of a long carriage or flyer. From this they are guided in even layers to the winding wheel. The result of the operation is called a "strand," and three or four strands are then twisted or "laid" into rope, according to whether a three-strand or four-strand rope is required. The rope is next put into coils by means of a coiling machine, and is then ready for packing and sending away.

A fine sewing thread is nothing less than a miniature rope, built up on the same principles as the largest cable of the greatest ship that floats. Because his product is of immense size, the cable spinner must employ a twisting machine large enough to occupy a whole staff of workers and a department of a factory; but the machine is only a huge example of the common doubler, hundreds of which may be held in a single frame. Perception of this fact has been at the root of the recent rapid development in rope-spinning by machinery. So long as the rope manufacturer thought himself alone in the industrial world, he kept to his own methods and crude machines. Later, realising that he also was a spinner, and learning from others of the craft, he was led into inventing machinery of great productive power and economic value. The principles of spinning remain the same, but the applications are immensely varied. In addition to heavy rope there are many types of cord and twine made by means of the machinery that has been described. The fishing industry takes many different types for lines and nets, while the variety of cord and twine for other industrial and for household purposes is almost unlimited.

Iron and steel wire is now extensively used in rope-making. Such ropes are used in the heavier parts of ships' rigging, and they have been introduced to a great extent in connection with mines, where they have brought about considerable economy on account of their durability and comparative lightness. Cords made of copper and brass wire are also made for electrical and other special purposes. Iron wire ropes are nearly equal in strength to solid bars of the same diameter, and are equal to hemp ropes of four times their weight.

In wire rope-making the wire arrives at the walks in coils or bundles, that are first wound on to bobbins and then placed in the forming machine that makes the strands, which are afterwards closed into the finished rope. In these machines the wire and strand bobbin frames are prevented from turning on their own axes during the revolution of the machine by means of an eccentric disc and cranks. In modern wire rope the strands usually contain from six to nine wires, and seldom more than 18. A "laid" rope consists of a heart, often of jute yarn, round which are twisted six strands containing a similar heart, usually covered with six wires. A "formed" rope comprises six strands laid round a heart, each strand consisting of 18 wires in addition to the core. A "cable-laid" rope is composed of six "laid" ropes, closed together to form one cable. A steel wire rope is 50 per cent. stronger than an iron one of the same diameter, and steel is therefore now almost universally employed in the manufacture of wire ropes. The strength of the steel wire generally used for ropes ranges from 70 to 100 tons per sq. in. of section. For certain special purposes steel wire having a tensile strength as high as 120 tons per sq. in. has been employed.



A modern rope-walk in operation. This photograph gives a good idea of the great size of the building.

In what are known as "locked coil" ropes the central wire core is surrounded by a series of layers of rounded and specially shaped wires, the shaped strands being so designed and arranged that they lock the other strands in position, and also lock one with another. In such a rope, if a strand becomes broken it is held in position. The layers of round wire are wound in one direction and the layers with the formed strands in the opposite direction, thus making the rope non-spinning.

The largest steel wire ropes employed in modern engineering are those used in the construction of suspension bridges. Each of the main cables of the George Washington Bridge across the Hudson River, New York, for instance, is about 3 ft. in diameter, and contains 26,474 parallel wires each .196 in. in diameter. These wires are grouped into 61 equal strands each containing 434 lengths or 217 loops of wire.

IX.—SIR GEORGE ROOKE

ONE of the most famous fighting Admirals in British naval history was Sir George Rooke, who began his career under the Stuarts and made his reputation in heavy fighting in the Dutch Wars. Later he played an important part in the long series of wars at the close of the 17th century in which the English and the Dutch in alliance were opposed to the French.

George Rooke was born near Canterbury in 1650, and was the second son of Sir William Rooke, Sheriff of Kent. Nothing is known of the early years of his career, beyond the fact that he entered the Navy as a volunteer at the time of the Second Dutch War in 1665, and at the very outset probably had a taste of naval fighting. When the Third Dutch War broke out some years later, he was a lieutenant in the "*London*," a flagship of Admiral Spragg, and in that vessel was present in 1672 at the battle of Solebay. The next year, still with Spragg, but this time in the "*Royal Prince*," Rooke took part in an engagement with the Dutch that resulted in the "*Royal Prince*" being dismasted and more than half of the 750 men on board killed or wounded. Spragg transferred his flag to the "*St. George*," but Rooke remained in charge of the disabled ship, and the courage and skill he showed in the heavy fighting were rewarded by his appointment to the command of the "*Holmes*."

The Third Dutch War ended in 1674, and during the ensuing 14 years of peace Rooke served in many different ships. The Revolution of 1688 placed William of Orange on the English throne and caused James II to flee to France, where he sought the aid of Louis XIV to regain his throne. Louis allied himself with James and declared war against England and Holland. A French army, accompanied by the exiled King, was sent to Ireland, and disembarked at Bantry Bay. While the French ships were there an English fleet under Admiral Herbert arrived on the scene. A short battle followed, at the close of which both sides claimed to be victorious. King William afterwards dined with the Admiral on board the flagship "*Elizabeth*" and created him Earl of Torrington, while two of Herbert's captains, John Ashley and Cloudesley Shovel, who were associated with Rooke in later engagements, were knighted. Rooke himself fought in this battle as commander of the "*Deptford*," a vessel of 50 guns.

Admiral Sir George Rooke. This illustration is from a print in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce it.

In May 1690 Rooke was promoted to Rear-Admiral of the Red and shortly afterwards he took part under Torrington in the battle fought off Beachy Head. There a combined English and Dutch fleet of 58 sail encountered 78 French vessels, commanded by Admiral Tourville, on 30th June. The French had the advantage of both wind and tide, in addition to superiority in numbers. At an early stage they succeeded in surrounding the Dutch squadron that formed the van of Torrington's line, and the Blue Squadron under Sir Cloudesley Shovel that was supporting it, and inflicted heavy damage upon these two portions of Torrington's fleet. After many hours' fighting the Dutch drew off, and on examination Torrington found that the ships of these two squadrons had suffered so seriously that he thought it advisable to destroy the vessels that were most badly damaged and to retreat eastward, towing the remaining disabled ships.

The English fleet headed for the Thames, and by tearing up all the buoys as it fled up the river rendered navigation too dangerous for the French to follow. The enemy therefore anchored off Torbay, and remained there until 5th August, when they retired to Brest. Torrington was tried by court martial for his failure in this engagement, and Rooke gave evidence in support of his Commander-in-Chief; but the subsequent acquittal of the Admiral was so unpopular among the Dutch that to pacify them William III deprived Torrington of his command.

In 1692 a much more powerful Anglo-Dutch fleet was assembled to oppose the French. It was actually the largest English fleet that had been seen in the Channel since the defeat of the Spanish Armada, and the 99 vessels of which it was composed mounted 6,676 guns and carried no fewer than 41,621 seamen and marines. This great fleet was under the command of Admiral Russell and, like that of 1690, was in three divisions, with Rooke as Vice-Admiral of the Blue Squadron.

The French were again menacing the south coast of this country, and on the 19th May, two days after putting out to sea, the English fleet sighted the enemy strung out across the Channel toward La Hogue Bay, where transports were moored in readiness to take on board a French army for the invasion of England. The French fleet was only half the size of that of the Allies and was again led by Admiral Tourville. Russell, the English commander, had been suspected of sympathy with the Pretender, and a desire for his return to England. Whatever his political views were, however, he had no intention of allowing the French to beat him, and before the English fleet drew near enough to engage the enemy, he visited most of his ships and exhorted the crews to do their duty, adding "If any of your officers play false, overboard with him, and myself among the first."

Early in the engagement a terrific fight took place between the flagships of the two commanders-in-chief, during which Tourville was compelled to transfer his flag to another vessel. Late in the evening a sudden fog put an end to the fighting, and taking advantage of it the French crowded on all sail and fled, becoming scattered over a wide area. Three of their ships, including the "*Soleil Royal*," which carried 104 guns and was then considered the finest ship in the French Navy, succeeded in reaching Cherbourg, but there they were discovered next day by Rooke, and under his orders Sir Ralph Delavel promptly attacked them, setting them on fire after driving them ashore.

Prevented by the fog from making a clean sweep of the enemy, Russell planned to follow up his success by again attacking the French fleet, the remnants of which had taken shelter in the bay of La Hogue. Shallows prevented the English ships of the line from entering the bay, and Russell instructed Sir Cloudesley Shovel to carry out the attack with a squadron of smaller ships. On the morning of the attack Shovel was ill and Rooke asked to be allowed to lead the attack in his place. His request was granted, and late on the 23rd May, he put off from the fleet in command of a flotilla that included sloops and fireships, and 200 ship's boats full of

armed seamen eager to get to close quarters with the enemy.

At dusk, the boats under Rooke's orders headed straight for six ships of the line that were moored under the shelter of one of the forts. The suddenness of the attack created a panic among the seamen on the French ships, and although the alarm was quickly given and the guns of the fort began to pour out a heavy fire upon the approaching boats, the six three-deckers were successfully boarded. Their crews were quickly dealt with and the English seamen then lashed the ships together and set them on fire before returning to their boats, when the ebb tide carried them out of range of the shore batteries. Meanwhile the flames crackled loudly on the doomed ships. Loud explosions as loaded cannon and the ships' magazines became involved added to the terror of the scene, and the fire raged throughout the night.

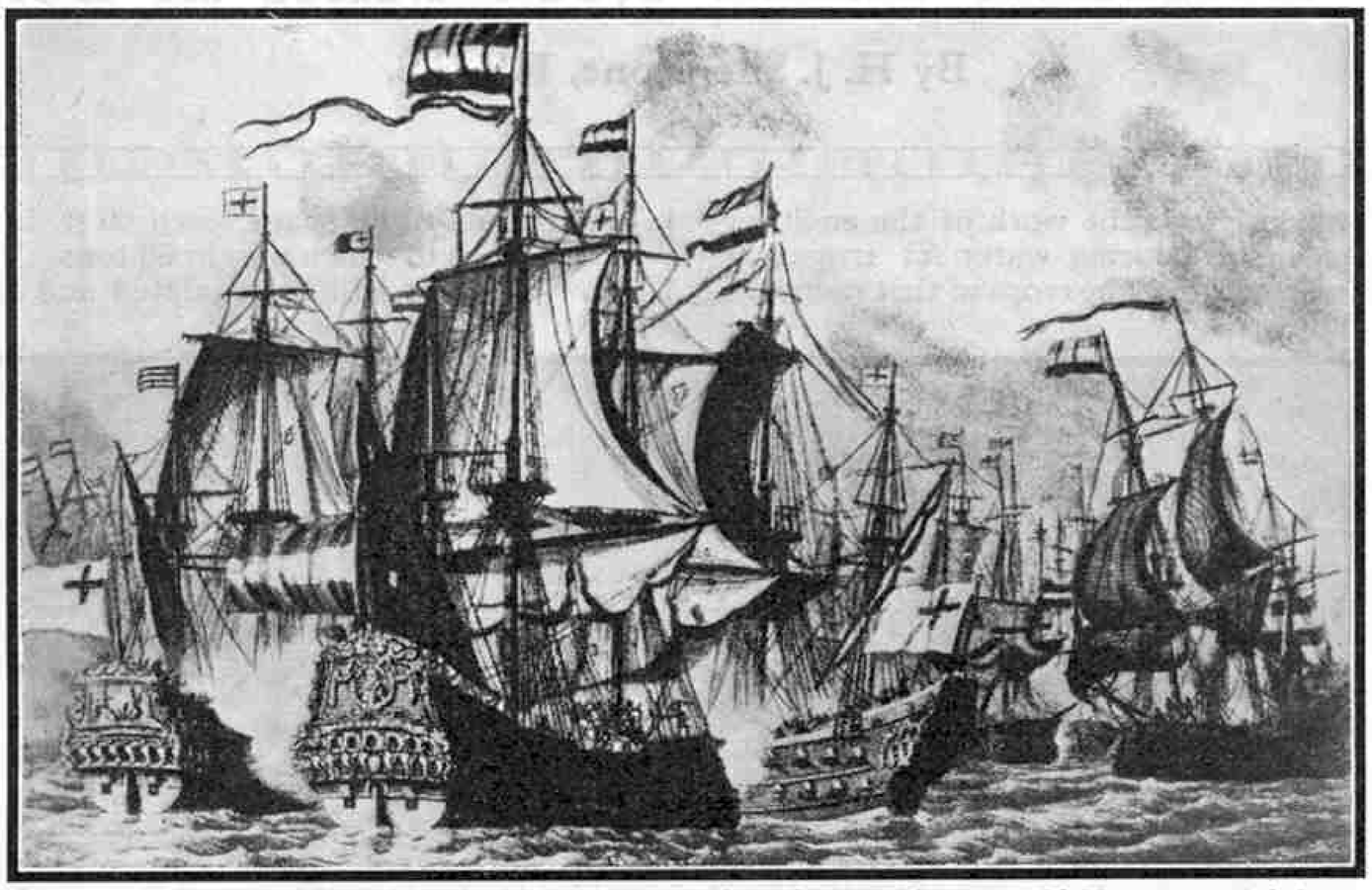
When the tide came in next morning, the boatloads of armed seamen returned with it to complete the work of destruction. This time they headed for some French ships of the line moored in front of another fort. The shore batteries were better served this time than on the previous night, for the second attack was made in full daylight, but after a short fierce fight the French ships were captured, and their guns turned against those on shore, which were quickly silenced. The French ships of the line, transports, ammunition tenders and store ships in that part of the Bay were destroyed, and the victorious seamen then rowed back to their ships, leaving behind them chaos and ruin.

When news of this success reached London there was great excitement and rejoicing. It was felt that the victory had saved England from the horrors of invasion, and bonfires were lit in the streets and flags hung from the church steeples to celebrate the victory. A medal also was struck, and £30,000 was distributed among the seamen concerned.

Rooke was awarded £1,000 for his part in the victory of La Hogue and next year he was knighted. Shortly afterward he was promoted Admiral of the White. In 1697 he was made Earl of Orford, and three years later was given command of a combined English and Dutch fleet that was despatched to the Baltic to support Sweden during her war with Denmark.

Then came the outbreak of the War of the Spanish Succession, in which France under Louis XIV, in support of the claims of his grandson Philip to the throne of Spain, was opposed by England, Holland and other European countries, who were determined that Spain should not come under French domination. Rooke played an important part in the naval warfare that ensued. With a powerful combined English and Dutch fleet of 50 sail of the line he sailed from Spithead on 1st July, 1702, to carry out an attack on Cadiz, accompanied by transports carrying an army of 13,000 men under the Duke of Ormonde, and many smaller vessels. Cadiz was reached a month later. Although it was discovered to be strongly defended, Rooke was all for a bold attack, but the Duke of Ormonde favoured an assault upon some place less strongly defended, and the result of this divided command was that eventually the expedition set off homeward without having accomplished anything.

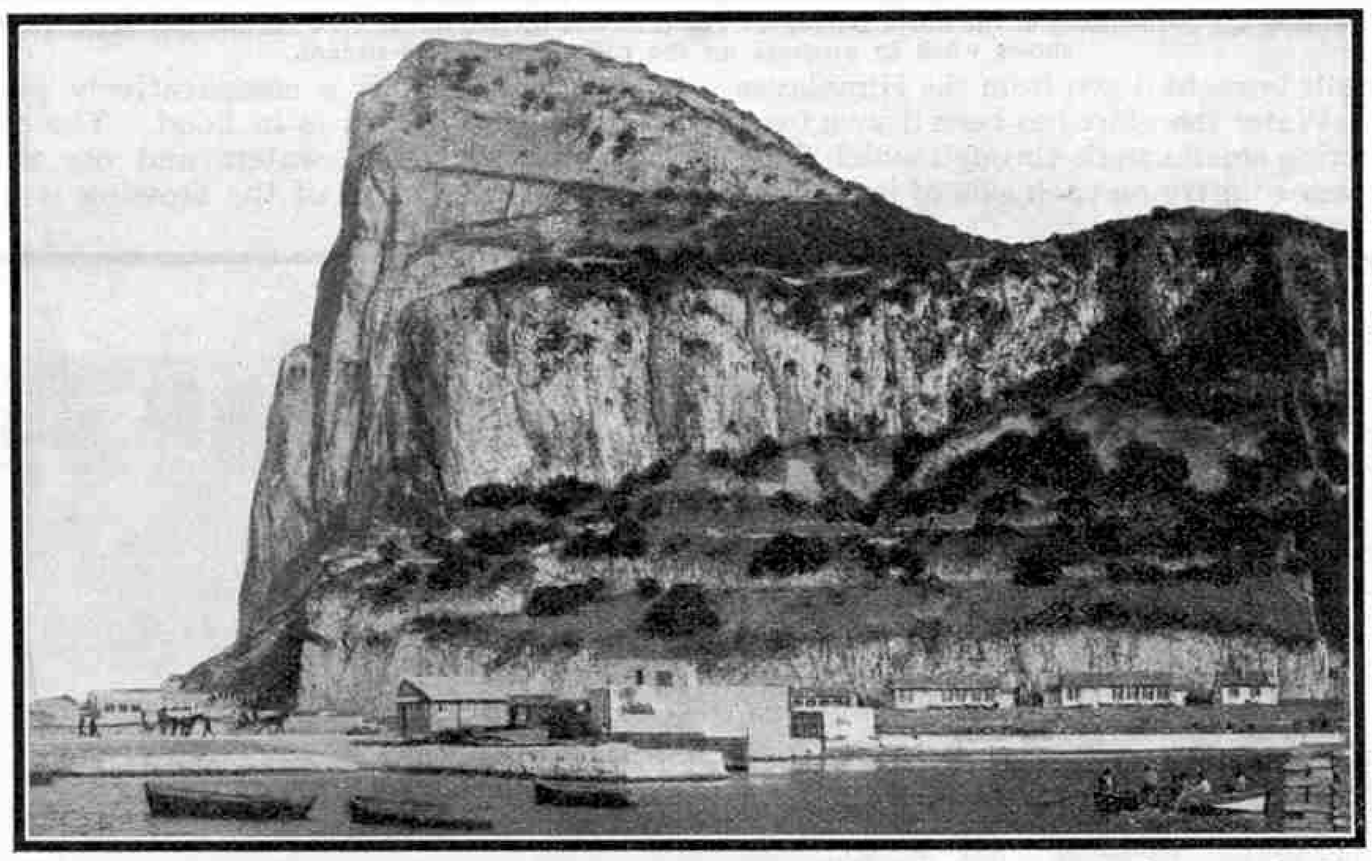
On the way back Rooke learned that a large fleet of Spanish treasure ships, convoyed by 18 French ships of the line, had reached Vigo harbour. He at once headed for Vigo, and on arrival found the harbour entrance guarded by numerous guns and the inner end protected by a strong boom built of spars and chains, on the shore side of which the treasure ships were being unloaded. The water was so shallow that only 25 of his ships were available for attack, but Rooke boldly led these into the harbour in the face of a heavy fire from the defending guns. The shore battery protecting the southern end of the boom was captured by 5,000 troops landed from the transports, and Rooke's 25 vessels ranged five abreast, then crowded on all available sail and bore down upon the obstacle, which gave way before them. A furious attack on the treasure fleet followed. Nine of the galleons and 10 French ships of the line were captured, and many other vessels were destroyed.



Seventeenth century English and Dutch ships of the line in action. Their square, highly ornamented sterns were a conspicuous feature of the vessels of that time.

During 1703 Rooke was ashore, but early the next year he sailed from Spithead in command of a small fleet to convoy to Lisbon the Archduke Charles, the Allies' choice for the throne of Spain. Shortly after his departure news reached London that the French were again preparing a powerful armament for an attack on this country. A strong fleet was hurriedly got together in order to reinforce Rooke, and when ready put out to sea under the command of Admiral Shovel. On 21st May Rooke sighted a French squadron that was heading for Toulon, and immediately gave chase. He failed to detain them, however, and then set out for Lisbon to await the arrival of Shovel's ships, which he met off Lagos, Portugal, on 16th June.

Rooke now had a fleet strong enough to engage the French when opportunity arose, but although he cruised about off the Portuguese coast for a month he did not encounter them. On 17th July the English fleet was off Tetuan, on the African side of the Strait of Gibraltar, and at a council of war held on Rooke's flagship *"Royal William,"* it was decided to make a sudden attack on the Spanish fortress on the famous Rock opposite, for it was realised that its occupation by the Allies would prevent the escape from the Mediterranean of the French fleet, which had not yet ventured to leave Toulon.



The Rock of Gibraltar, 1,408 ft. in height, on the northern side of the narrow Strait connecting the Atlantic Ocean and the Mediterranean Sea. Rooke was in command of the fleet that captured this famous stronghold by a sudden assault in 1704.

Gibraltar was not as strongly defended then as it is to-day, but about 100 cannon were distributed at vantage points about its walls. Early on the morning of 21st July the fleet entered Gibraltar Bay, and later in the day 1,800 men led by the Prince of Hesse effected a landing on the isthmus north of the town, and cut off the garrison from the mainland. When possession of the narrow neck of land had been obtained, the Prince sent a message to the Governor calling upon him to surrender, but the Governor declared that the garrison would defend the fort to the last man. Two days afterwards a violent cannonade was opened upon the town and the southern mole. (*Continued on page 884*)

Fighting Famine in India

II.—Irrigation Canals 6,000 Miles in Length

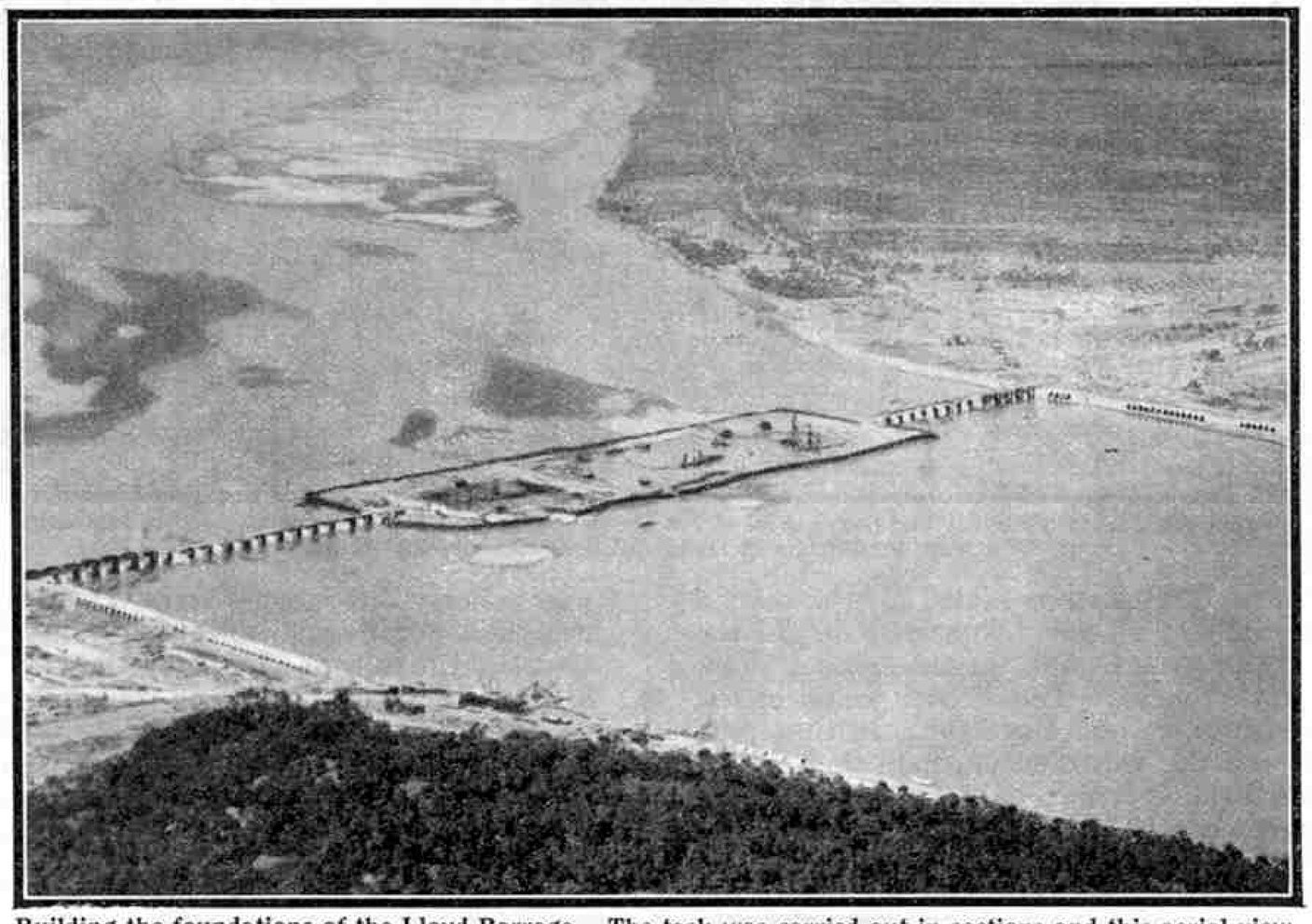
By H. J. Shepstone, F.R.G.S.

IN the September "*M.M.*" we described the work of the engineer in India in providing means of storing water for irrigation purposes. The task of safeguarding the crops of that immense country, and thus of averting the risk of famine, is far from complete, however, and in recent years even larger and more daring projects have been planned and carried out. The greatest and most spectacular of these is the recently completed Lloyd Barrage across the River Indus at Sukkur in Sind, and its great system of irrigating canals. Its construction demanded nine years of patient toil in a hot arid land, far from the centres of civilisation, and called for an expenditure of £15,000,000.

Sind is practically the same size as England. It is almost rainless, and the Indus is its only river. Fortunately this great stream does not flow through a valley, but on top of a ridge, for the silt brought down from the Himalayas has gradually raised its bed. Water therefore has been drawn from it for centuries by simply cutting small canals through which flood water could run on to the lower country on each side of its course. This haphazard irrigation scheme was not very efficient, for the flow of water in the river varied, and the canals themselves readily silted up and became useless.

The harnessing of the Indus was desirable for several reasons. One was the necessity for providing perennial irrigation for a large area of Sind, a province remarkable for its desert and the poverty of its inhabitants. Another was that irrigation schemes in the Punjab had been completed, or were in progress, that would use water from the tributaries of the Indus, and thus reduce the flow of the river in Sind at the time when it was needed by the peasant farmers dwelling on its banks.

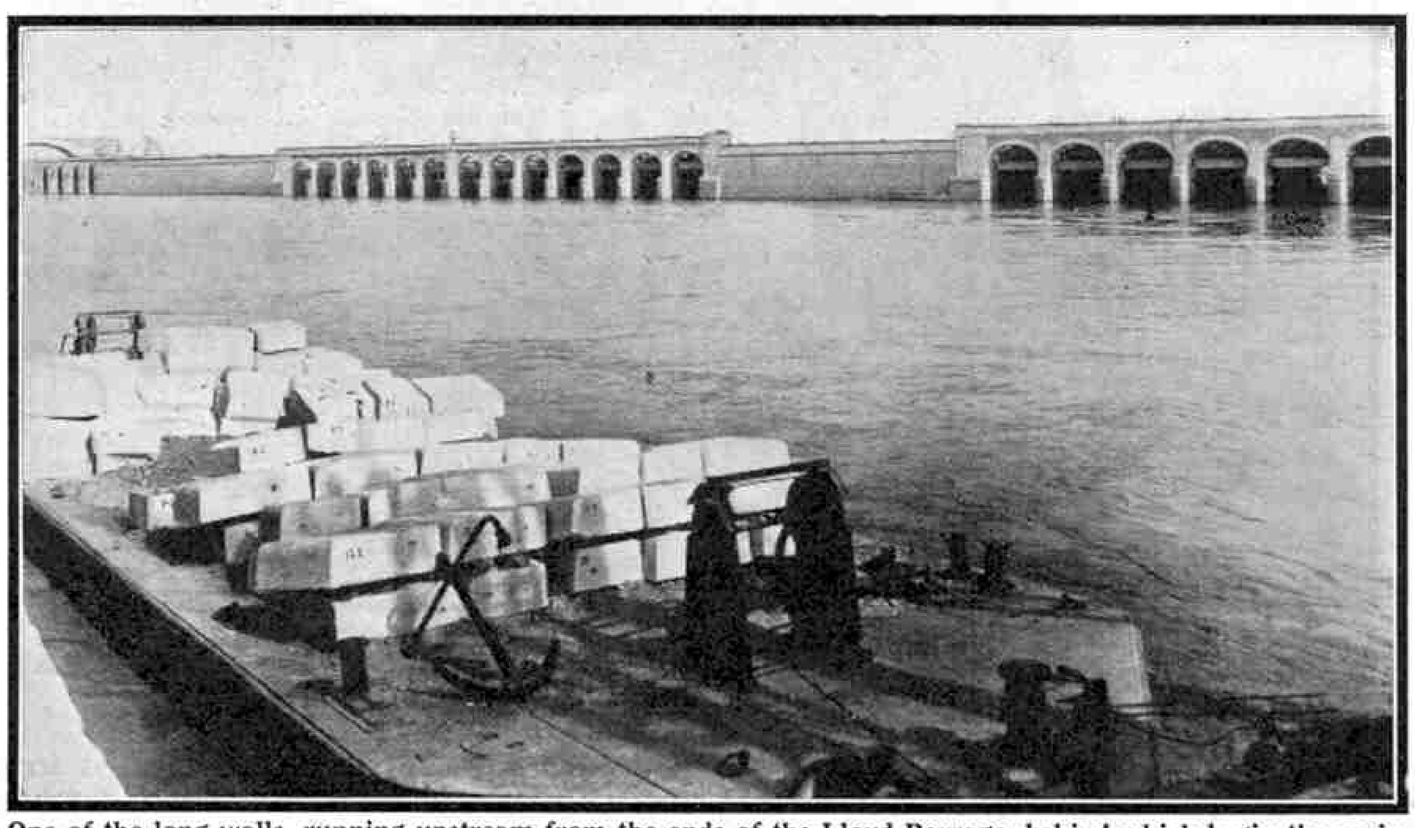
After prolonged surveys it was decided to harness the stream at Sukkur, a little town about 400 miles from the mouth of the river, and there the Lloyd Barrage has now been completed. This great retaining wall across one of the world's most noted streams is about a mile in length, or about five times the length of London Bridge. It consists of 66 spans, each 60 ft. in width, pierced by as many gates, each of which weighs 50 tons. By means of this Barrage the flow of water will be regulated and the water turned into canals specially dug to irrigate what has hitherto been desert land. There are 6,166 miles of these canals, and they spread out over the surrounding territory like the veins of a man's hand. The final distributing channels will have a total length of about 50,000 miles. Most of these will be constructed by the farmers themselves, and the water they carry will be the means of bringing more than 7,000,000 acres of the parched and waste land under cultivation, and thus of reclaiming an area nearly twice that of Wales.



Building the foundations of the Lloyd Barrage. The task was carried out in sections and this aerial view shows work in progress on the cofferdam in mid-stream.

The Indus is one of the mightiest and longest rivers in Asia. It rises in Tibet and flows for a distance of 1,800 miles along the north-west frontier of India. For eight months of the year it is a comparatively placid stream, but during the remaining four it is in flood. The task of the engineers was to control the flood waters and use them for irrigation purposes.

The actual site of the crossing is about three miles below the Lansdowne Railway Bridge at Sukkur. There, right in the heart of the wilderness, a modern camp was built and the necessary machinery and equipment assembled, a formidable task in itself. Quarters were erected for the engineers and their staffs, and arrangements made to house the thousands of native labourers employed on the scheme. Factories, workshops, repair shops, a locomotive depot, block-yards and a power station were built; quarries were opened up and connected with the spot; and 64 miles of railway were laid down, and miles of roads built in order to enable essential supplies to reach the camp.



One of the long walls, running upstream from the ends of the Lloyd Barrage, behind which begin the main irrigation canals that carry water to the distribution channels. Our photograph shows the wall on the right bank with the gates that admit water to three of the canals.

Work on the barrage was begun in July, 1923, and it proved no light task on account of the peculiarities of the Indus. When the river is in full flood, the flow at this point is very rapid, exceeding 1,000,000 cu. ft. per sec. in volume, with a velocity of about 7 m.p.h. Further, the scour or erosion is tremendous, and uncertain in its action or direction. This meant that the barrage had to be

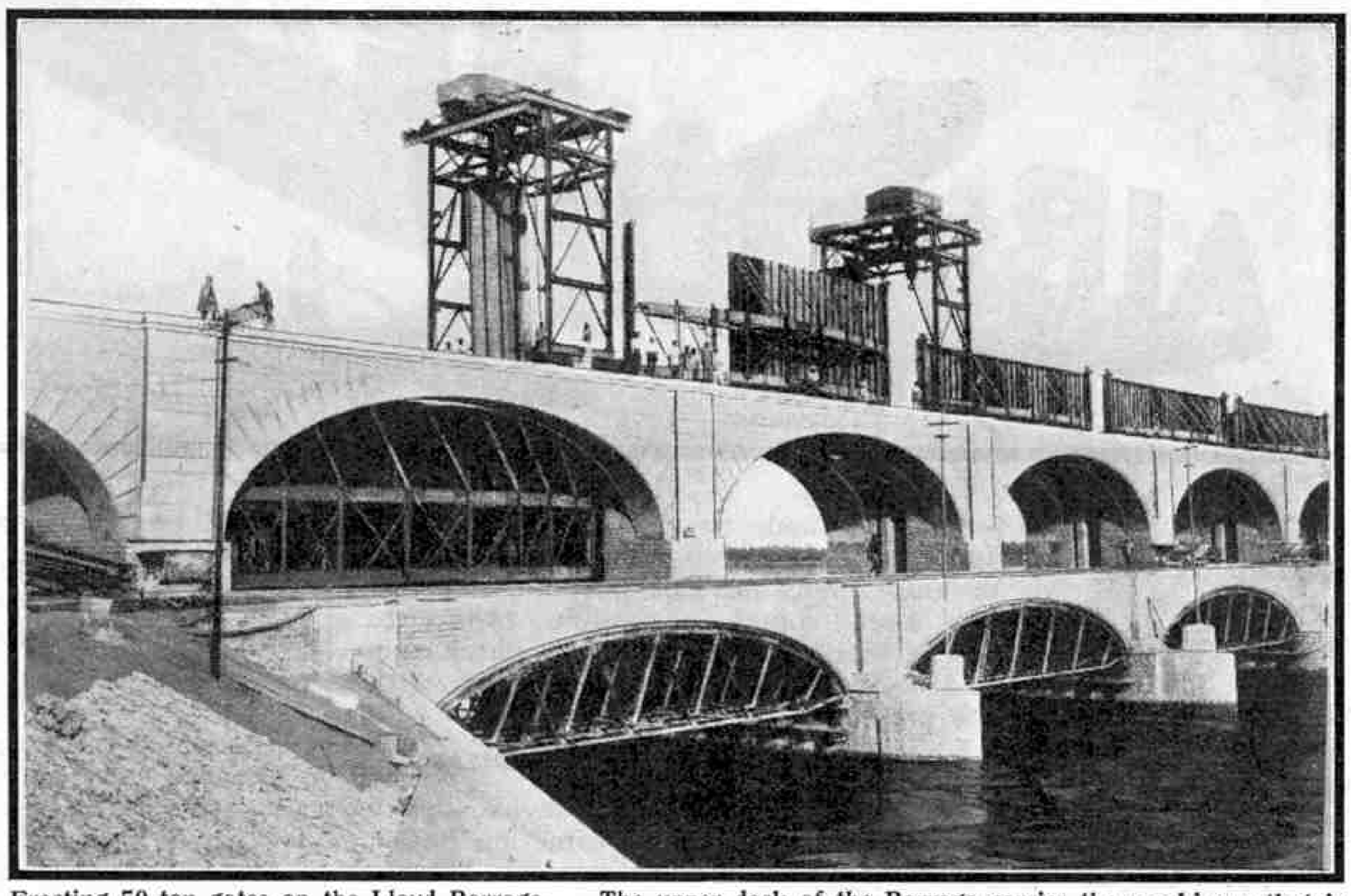
built in sections by means of cofferdams, which were of immense size. One of them enclosed an area of 46 acres, and is believed to have been the most extensive ever constructed. They had to be sunk in the dry season, and their building often called for feverish work before the river rose again, for a miscalculation or an unexpected flood would have meant the ruin of a whole season's labour. For this reason the work was carried on day and night without cessation, powerful arc lamps providing light for night operations. The cofferdams were built of interlocking steel piles driven deep into the river bed by means of pile-drivers mounted on pontoons. The water was then pumped out, and the foundations were secured.

As the silt of the river bed was found to be so deep that it was impossible to reach a solid foundation for the Barrage, a novel method of construction was necessary. The great barrage stands on what is in reality a raft, 190 ft. in width, fashioned of huge concrete blocks. In order to prevent water from working under this foundation, the river bed is lined to a distance of 120 ft. on each side of the concrete base with heavy stones laid close together, and as a further precaution against the possibility of damage by seepage, the edges of these stones, both on the upstream and downstream sides, are protected by sheet piling. There are also two auxiliary lines of piles under the raft, these being spaced towards its centre.

This unique foundation extends right across the river, and upon it rises the barrage, built of a creamy white limestone resembling marble, the arches alone being of a different material, namely, reinforced concrete. The massive structure towers 60 ft. above the bed of the stream. Its 66 spans, each 60 ft. in width, are separated by 58 ordinary piers each 10 ft. in width, and seven abutment piers each 25 ft. in width. The total width of the waterway provided is 3,960 ft. and the overall length of the barrage between abutments is 4,715 ft.

The structure is designed to pass a maximum river flood of 1,500,000 cu. ft. per sec. Each span in the Barrage is fitted with an adjustable steel gate, and these gates are the largest and strongest ever designed. They have a clear width of 60 ft. each, and 54 of them are 18½ ft. in depth, the remaining 12, which occupy positions near the banks, being 22½ ft. in depth. When the river is running full, each gate will be called upon to withstand a pressure of about 300 tons.

The great Barrage is in reality a kind of double-decked bridge. The lower deck is the "road bridge" destined for the use of ordinary traffic. On the higher deck, known as the "gate bridge," is the mechanism for lifting and lowering the gates, an operation that can be carried out by two men, the time required to raise one of them through 32 ft. being 50 min. In order to deal with sudden floods or other emergencies it may become necessary to raise the gates more quickly, however. Six travelling trolleys equipped with electric motors have been provided for this purpose, and their use enables all 66 gates to be raised to their greatest heights in about 1½ hrs. Sockets are placed at intervals along the Barrage in order to enable current to be supplied through plugs and lengths of cable.



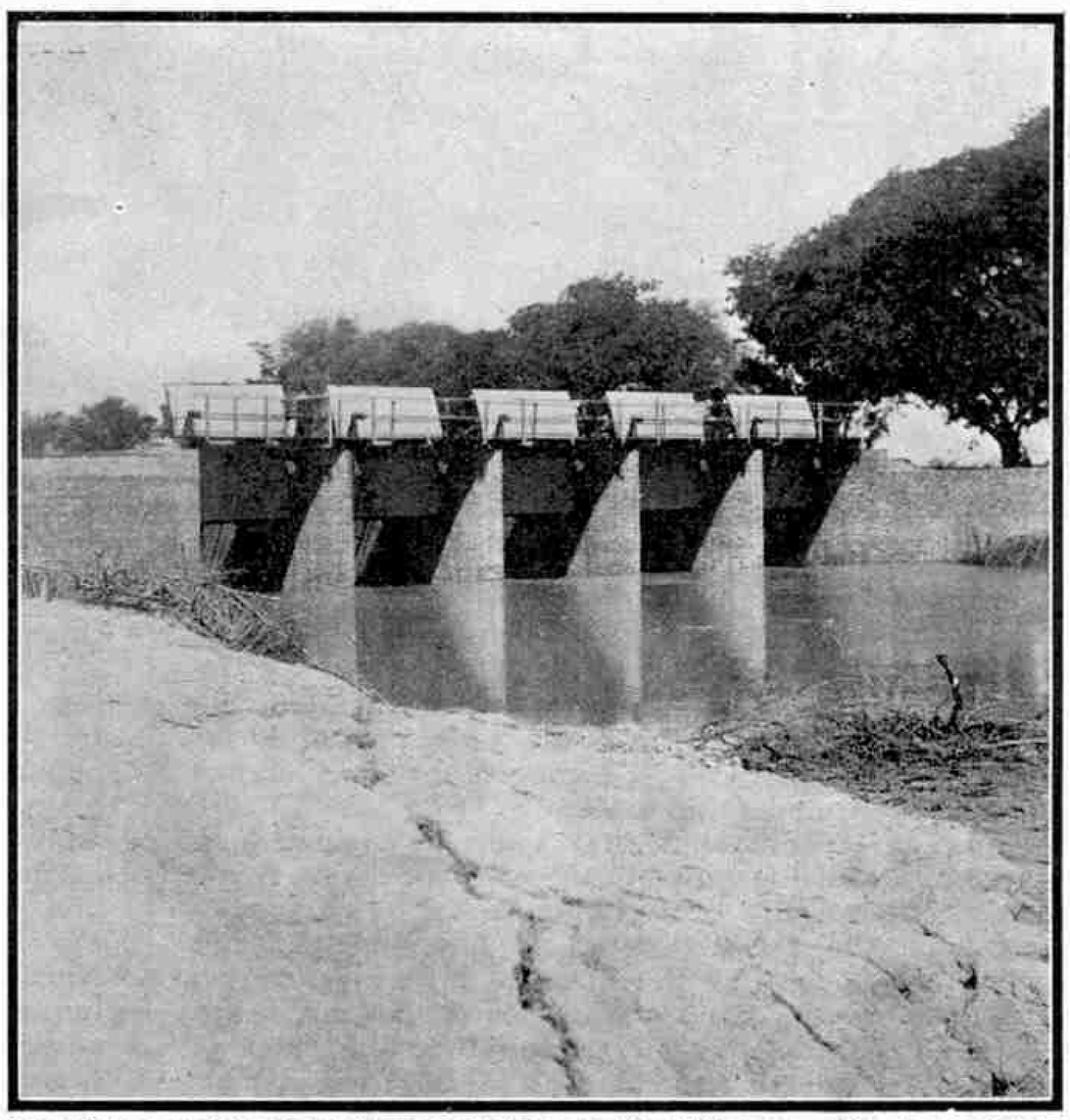
Erecting 50-ton gates on the Lloyd Barrage. The upper deck of the Barrage carries the machinery that is employed for raising and lowering the gates, and the lower deck is a roadway.

From each end of the great retaining wall two long walls run upstream, the one on the right bank measuring 1,690 ft. in length, and that on the left 1,975 ft. The canals start behind these walls, three on the left bank and four on the right, water being admitted into them by 55 sluice gates each having a span of 25 ft. They are kept free from silt by means of the 12 gates, already referred to, that have been erected near the banks of the river. These are known as scouring gates, and there are seven at one end of the Barrage and five at the other. When they are open, powerful currents sweeping along the banks carry the silt away from the openings of the canals.

The construction of the canals and other distributing channels involved the excavation of 210,000,000 cu. yds. of sand, earth and rock, or about twice as much spoil as that removed in cutting the Panama Canal.

The digging of these canals was a remarkable engineering feat in itself. They were excavated by means of a fleet of 46 draglines, or steam-navvies with huge buckets that are dragged towards the machine by means of a flexible cable. Draglines had never previously been used in connection with irrigation works in India, and were employed in Sind on account of the scarcity of hand labour and the necessity of completing the canals to a time schedule. Nine of them were of large size, seven medium, and 30 small.

The larger draglines were the biggest of their kind, turning the scale at 350 tons, and carrying jibs 120 ft. to 130 ft. in length. Their buckets had a capacity of 8 cu. yds., sufficient to fill an eight-ton wagon with a single cut. The bucket could be lowered, the cut made, and the excavated material raised and dumped into a waiting wagon, or on to an embankment, in 45 sec. It is estimated that one of these machines was capable of doing the work of 8,000 coolies.



One of the canals that distribute water from the Lloyd Barrage. The five regulator gates control the flow of water along the canal.

These immense excavators worked in pairs, each machine digging one half of a canal and dumping the earth to form the canal bank. They were principally employed in excavating the main canals, of which there are seven. These canals are no mean streams, for they run for hundreds of miles, are from 79 ft. to 346 ft. in width, and from 4 ft. to 20 ft. in depth. The total capacity of the machines working on the task of cutting their courses was roughly 74 tons of earthwork excavated and dumped per minute, or 1.23 tons per second, day and night, for 5½ days in the week and 250 days in the year. In their absence it would have required an army of

(*Continued on page 884*)

Unsubsidised Indian Air Line

An interesting unsubsidised air line, known as the Tata Air Mail Service, is now being operated in India. The service, which is for mails only and is operated by D.H. " Puss Moth " machines, connects Karachi and Madras. The first section of the journey is along the coast from Karachi to Bombay, and after this the Western ghats are crossed to Poona, from where the route descends to the plains, to Bellary. These three sections of the journey are flown in one day, and on the second day the remaining 266 miles to Madras are completed by 9.15 a.m. On the return journey the machine leaves Madras late at night, spends the night at Bellary, and reaches Karachi in time to catch the Imperial Airways air mail liner on its westward flight.

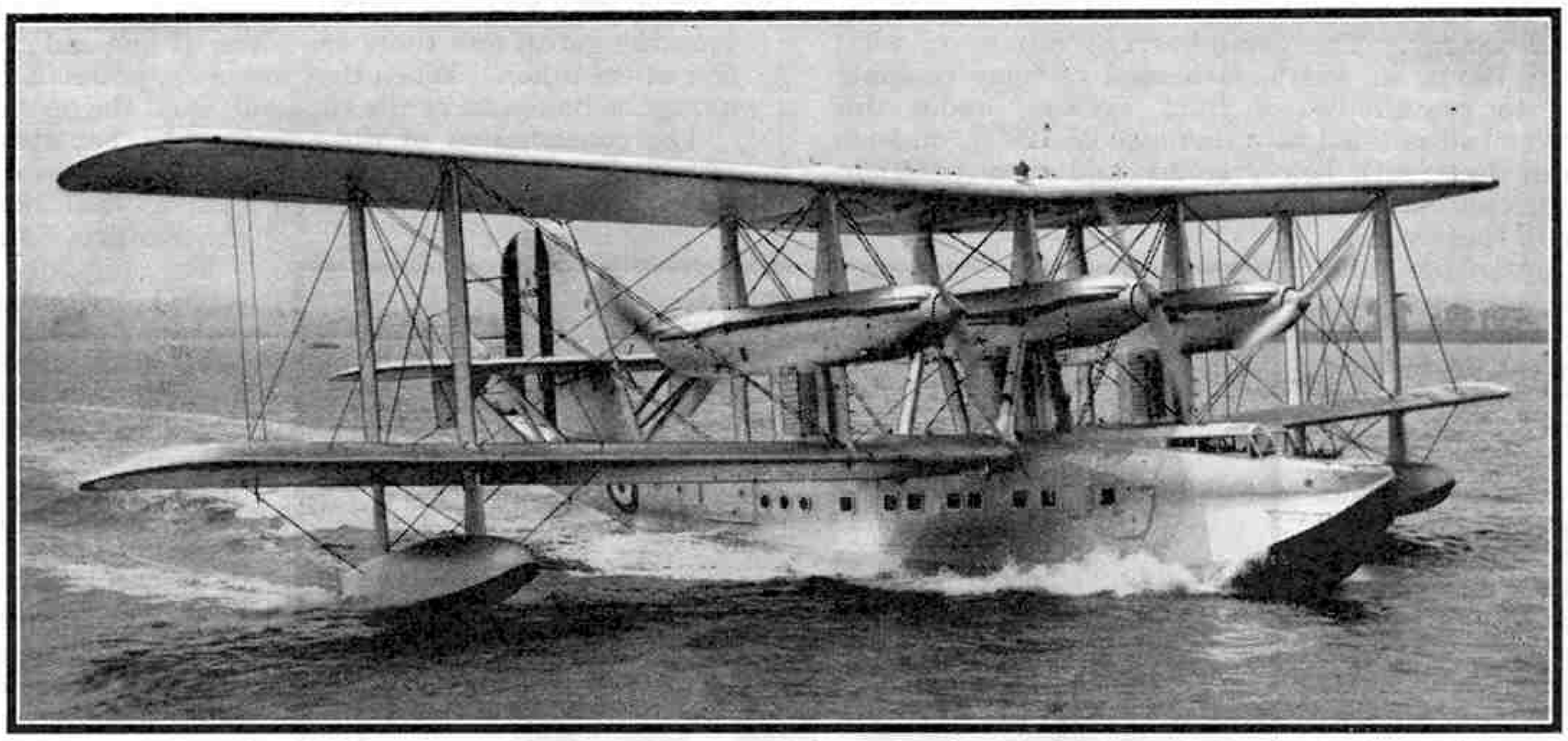
During the monsoon period the headquarters of the service are moved from Bombay to Poona,which gives the machines an easier route to follow. It is hoped, however, that before the monsoon period next year all the aeroplanes in service will have been equipped with wireless apparatus, and consequently will be able to fly across the Ghats and maintain the same service all the year round. It is also contemplated that the service should be extended from Madras to Colombo, and negotiations with the Governments of Ceylon and India are now being carried out with this end in view. A difficulty in the way of such a service is that there is no aerodrome at Colombo, and it is improbable that one will be built for some time. It is therefore proposed that the service should run only to Manaar, the railhead on the north west coast of the island, nearest the mainland of India, from where the mail would be carried to Colombo by night train. The sea crossing between India and Ceylon would be made in the " Puss Moths." It was at first hoped to employ seaplanes or amphibians for this purpose, but this has been found impossible owing to the greater costs, both of purchasing and of operation, as compared with the present landplanes.

" Homing " Device for Aeroplanes

An interesting " homing " device, known as the Marconi-Robinson direction finder, has been fitted in all Imperial Airways machines of the Armstrong-Whitworth " Atalanta " type. The device can be fitted to any existing Marconi receiving installation, and makes it possible for a pilot to direct his machine to any known ground radio station.

The system makes use of a single-loop aerial fastened to the wings of the machine, and also of a trailing aerial. Normally the trailing aerial is disconnected, and so long as the machine is flying head-on to the radio station, no signals are heard in the pilot's earphones. If the machine diverges from its course, however, signals are heard. The pilot then switches into circuit his trailing aerial, and is able to tell from the strength of the signals whether the transmitting station is to left or right. He then adjusts his course until signals of equal strength are received, when he knows that the nose of the machine is once more pointing directly to the transmitter.

This type of " homing " device is particularly suitable for service in regions where there are no direction finding stations.



This Short machine is one of the largest flying boats constructed in this country. It is equipped with six 820 h.p. Rolls-Royce " Buzzard " engines. Our photograph is published by courtesy of Short Bros. (Rochester & Bedford) Ltd.

Parachute for Passenger Use

A new Irvin parachute has been produced for the use of passengers in commercial aircraft. It is very simple to put on, the harness being arranged so that the passenger sits in it as in a swing; and as soon as the parachute opens the straps automatically adjust themselves to the passenger. A seat pack is used, and when in the aeroplane this is practically hidden in the upholstery of the seat. During a test with the new type of harness Mr. John Tranum, the famous parachute jumper, dropped out of a " Puss Moth " at an altitude of 1,200 ft.

The harness is not worn during normal flight, and when it is necessary to put it on the passenger moves two pieces of webbing, connected to the harness, across his lap, and tightens them with a slight pull. Shoulder straps at the top of the seat are then eased into position, and the passenger is ready to jump. The great feature of the apparatus is that it incorporates the main principles of the Irvin parachute, namely, that the shock of the opening of the fabric is distributed over the body, and that straps across back and front are provided to prevent the jumper from falling backward or forward. Another important detail is that the point of suspension is at the shoulders. All these features have been attained without the customary necessity of adjusting the harness to the size of the wearer.

World's Altitude Record

A new altitude record of about 63,320 ft., or more than 12 miles, has been set up by three Russians in the Soviet balloon " *Stratostat U.S.S.R.*" The flight lasted for 8 hours 15 min., and during the whole of the time those in the balloon were in radio communication with people on the ground.

French Subsidy for Low Powered Aeroplanes

For many years the French Government have granted State aid to flying enthusiasts who wish to buy their own aeroplanes, by advancing a certain amount of the purchase price. It has now been decided to include in this scheme those who wish to buy ultra-light machines, similar to the Lowe-Wylde "Planette," which has been described at various times in these pages. The new subsidy is available for aeroplanes employing engines that do not develop more than 50 h.p. The aeroplanes must have a certificate of airworthiness and be able to fulfil certain conditions, included among which is the ability to carry 200lb. of useful load, equal to the weight of the pilot and a parachute, and to have an endurance of at least 2½ hours.

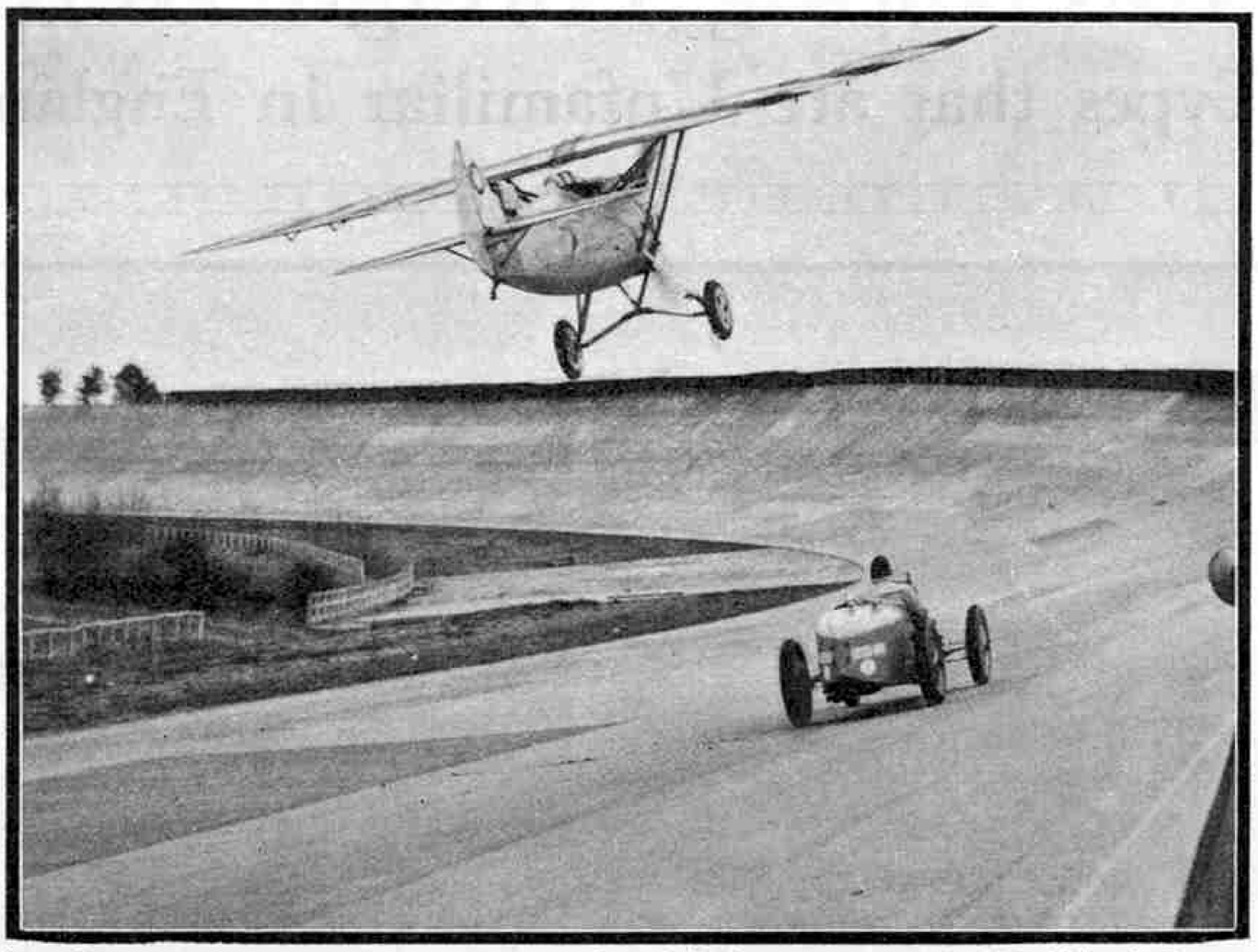
An interesting feature of the granting of the subsidy is the fact that before any money will be granted, orders for at least 20 machines must have been received by the constructors. The aeroplane must also be insured. Another stipulation is that the purchase price of the machine must not exceed 20,000 francs. The State subsidy granted on a machine costing this amount is 7,000 francs, which means that the cost to the purchaser will be 13,000 francs, or, in English money, about £154 at the present rate of exchange!

Aeroplane Flown by Untrained Pilot

During the Yugoslavia King's Cup Air Race this year an exciting incident occurred when, during very rough weather, one of the pilots was thrown out of his aeroplane. The navigator, who had never had any instruction in flying, climbed with great difficulty into the pilot's cockpit, took charge of the controls, and managed to pilot the machine safely to an aerodrome some 30 miles away. On arrival there, after several unsuccessful attempts he managed to land with only small damage to the machine and slight injuries to himself. The pilot was saved by his parachute.

New Air Survey in Australia

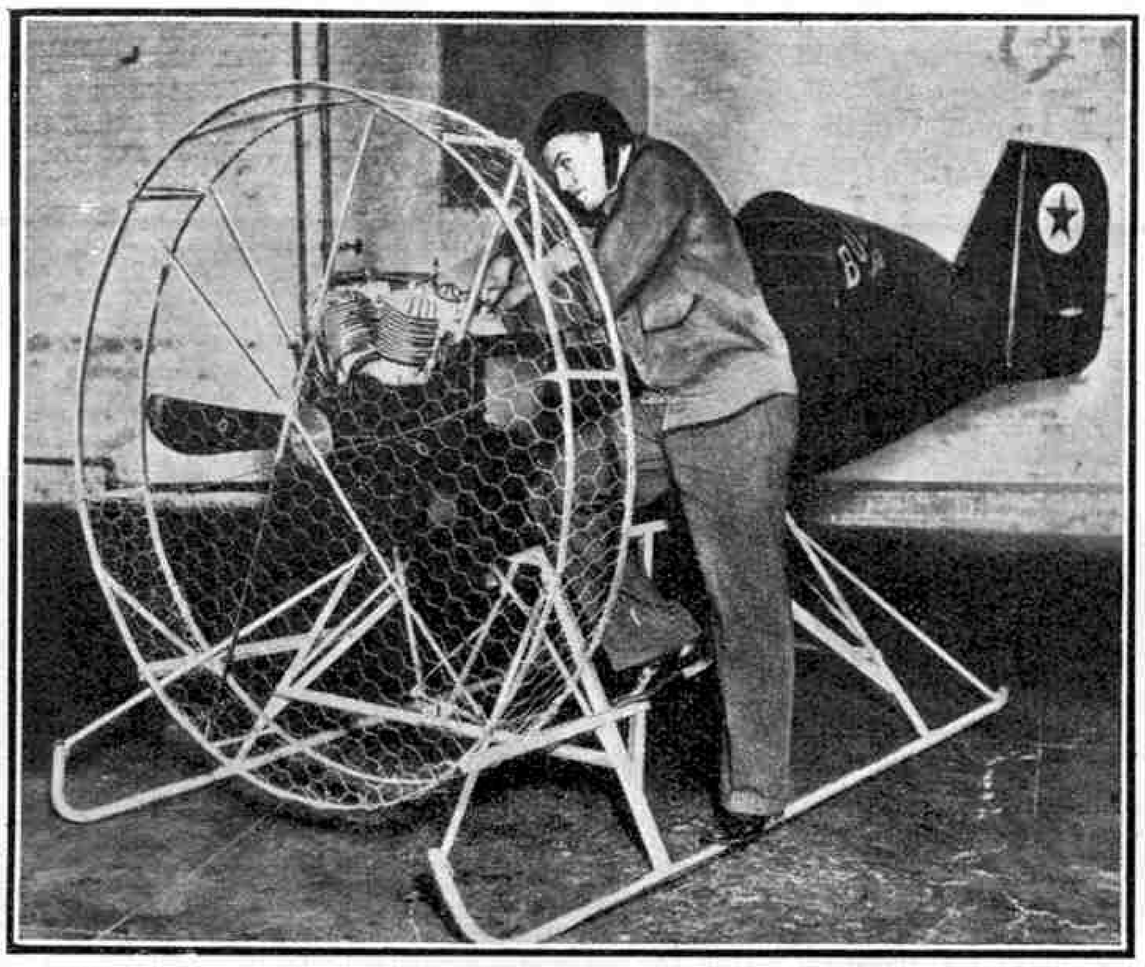
The geological survey of an extensive area in the gold mining districts of Western Australia is to be carried out by air. The work is being done on behalf of the Western Mining Corporation Ltd., and the area to be photographed is estimated at about 88,000 sq. miles. In order to expedite the survey the aircraft employed will be controlled by radio from a number of ground stations, at which there will be a staff of geologists and surveyors. The machines chosen for the work are D.H. "Dragons" equipped with two "Gipsy" engines.



A race in progress between a motor car and an aeroplane at the famous racing track at Montlhéry, in France. The race, which was four times round the track, was won by the aeroplane.

High Speed Polish Aeroplane

One of the most interesting Polish aeroplanes yet produced is the P.W.S.54, a high wing commercial monoplane designed and built for the Polish Ministry of Communication by the Podlasian Aircraft Manufacturing Company of Warsaw. This machine is probably the fastest commercial aeroplane in Poland, having a maximum speed of 145 m.p.h. and a cruising speed of 124 m.p.h. It is a five-seater, with a cockpit for one pilot and a separate cabin for four passengers. The machine is of steel tube construction, but has wooden wings, which are internally braced and are built up round two box spars. They are 30 ft. 6 in. in span, and the machine is 30 ft. 5 in. in overall length. The fuel tanks are provided in the wings on both sides of the fuselage, the total capacity being 85 gallons.



An 18-year old inventor with his "ice-plane," which he has built himself. He is able to skim along the ice at high speeds in the machine.

Eight-Seater Westland "Wessex"

On various occasions we have published photographs and information concerning the Westland "Wessex," a very economical commercial high wing monoplane equipped with three Armstrong Siddeley "Genet Major" seven-cylinder engines. The standard version of this machine is a six-seater and has an all-up weight of 6,000 lb., but a slightly modified type is now available as an eight-seater, without sacrifice in range. The new version employs the same engines, but the all-up weight has been increased to 6,300 lb., room for the extra two seats having been obtained by slight rearrangement of the luggage compartment. If a machine is intended purely for joy riding and short ferry services, arrangement can be made for an eight-seater to be provided, with a normal gross weight of 6,000 lb.

The "Wessex" eight-seater has a maximum speed at ground level of 122 m.p.h., and cruises at 105 m.p.h. It has a duration of four hours, during which time 430 miles can be covered. An interesting feature of the machine is that it is arranged for wireless apparatus to be fitted with a minimum of trouble.

New American Aero Engine

Two new radial air-cooled engines have been produced by the Pratt and Whitney Aircraft Corporation of Hartford, Connecticut, U.S.A. The engines are the "Twin Wasp-Junior" and the "Twin Wasp," and both have 14 cylinders arranged in two banks. The engines have been produced after development work that has occupied about four years, and are intended to meet the demand for higher-powered radial engines than can be obtained with the standard single-bank type. The use of two banks also makes it possible for smaller cylinders to be employed, so that the overall diameter of the engine is reduced; while reduction in the reciprocating weights allows higher crankshaft speeds to be employed. Both the engines are fitted with superchargers and reduction gears.

The cylinders of the "Twin Wasp-Junior" have a bore and stroke of $5\frac{3}{16}$ in. The overall diameter of the engine is $43\frac{7}{8}$ in., it measures 53-21/32 in. in overall length, and develops 675 b.h.p. at 2,400 r.p.m. at an altitude of 7,000 ft. The "Twin Wasp," which has cylinders with bore and stroke of $5\frac{1}{2}$ in., is $47\frac{7}{8}$ in. in overall diameter, 56-15/16 in. in overall length and 1,195 lb. in weight. It develops 775 h.p. at a speed of 2,400 r.p.m. at 5,000 ft. Both engines are suitable for use in either military or civil aeroplanes.

Some Interesting Foreign Aeroplanes

Types that are Unfamiliar in England

FOR some months we have dealt in these pages with interesting British aeroplanes in the series entitled "British Aircraft Developments." This month we describe four interesting foreign machines, representing types that are very rarely seen in this country. These machines are the French Blériot 290 sesquiplane amphibian, the German Darmstadt D.22 cantilever biplane, the American Gee-Bee "Super-Sportster" racing monoplane, and the German Junkers "Junior" light monoplane. These all differ in type and use, but are all well known, not only in their country of origin, but also in other parts of the world.

British aircraft constructors are noted for their flying boats and other marine aircraft, but no machine similar to the Blériot 290 is built in this country. This is a cabin amphibian with accommodation for three. It is a sesquiplane, which means, literally, that it has "one-and-a-half" wings, the top wing carrying the pusher engine, which is a Salmson 9Ab radial air-cooled engine developing 230 h.p. This wing, which is 47 ft. 11 in. in span, is constructed of wood and covered with fabric, as also are the two small lower wings that are attached direct to the hull, a rectangular structure made of wood and provided with two "steps." The undercarriage of the machine is of the retractable type, consisting of two spring legs arranged so that they will lift the wheels sideways and house them in the bottom wings. This operation is carried out by turning a wheel near the pilot's seat, and an indicator is provided on the instrument board of the machine to show the pilot the position of the wheels at any moment.

The accommodation is arranged so that the pilot is seated centrally and the passengers on a double seat behind him. There is a large door on each side of the cabin, and space for luggage, marine gear, etc., is provided in a compartment in the nose of the hull, entrance to which is gained through a water-tight hatch. The machine is about 31 ft. 9 in. in length, and weighs 2,739 lb. when empty and 3,740 lb. when fully loaded. It is capable of attaining a maximum speed of 114.8 m.p.h., and has a range in still air of about 325 miles.

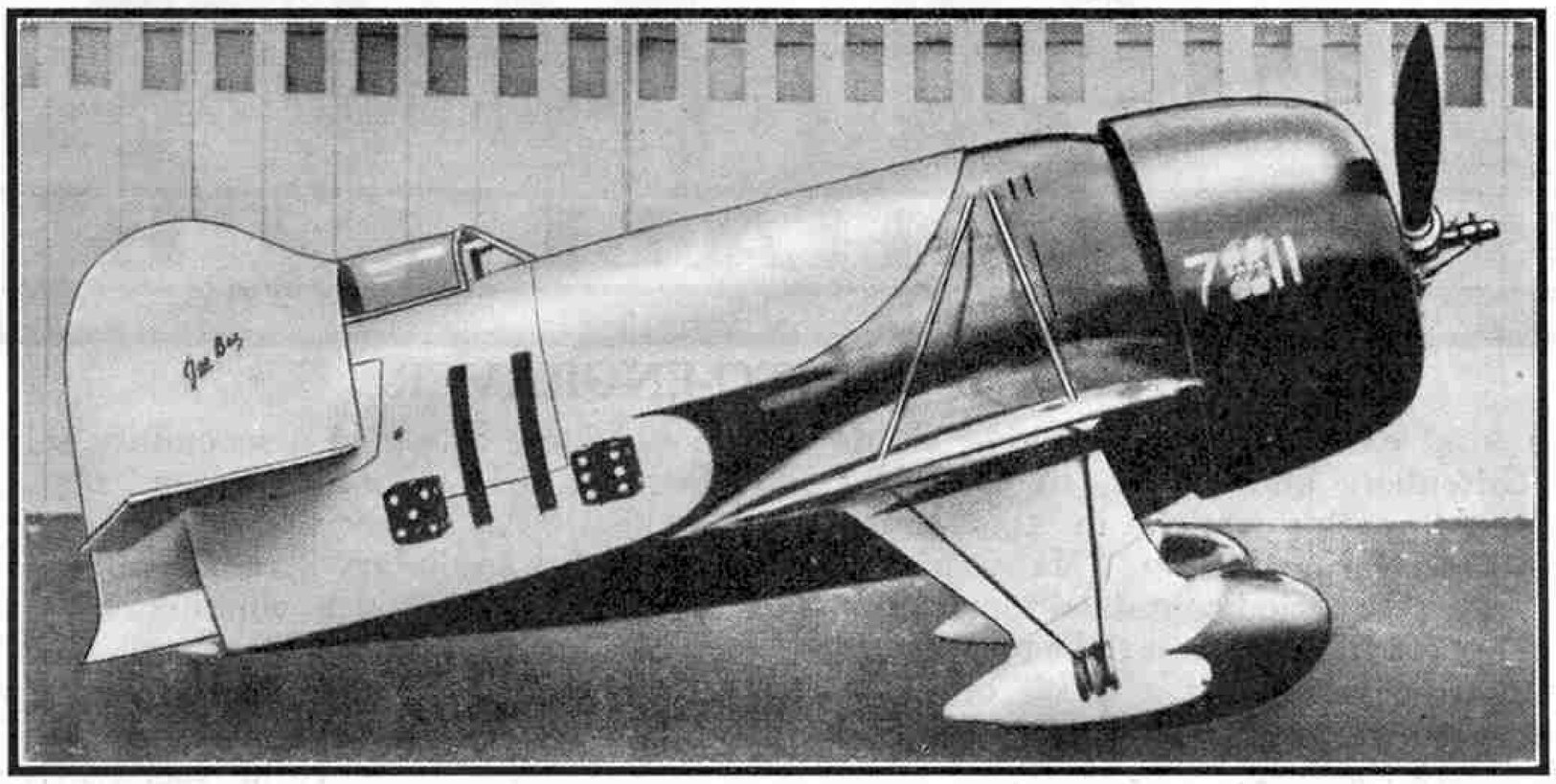
This interesting machine has proved very popular in use, but unfortunately the Blériot company have now closed down on account of the difficult trade conditions that have been experienced during the last few years. M. Louis Blériot, the president and founder of the firm, was, of course, the first man to fly the English Channel. He has been interested in aviation since 1899, when he established his first aeronautical works. The crossing of the Channel was made on 9th July, 1909, on one of his own machines, and since then his company have produced a large number of interesting and successful machines, including the Blériot 110 in which a world's record for distance over a closed circuit was set up by two French pilots.

The upper illustration shows the Blériot 290 sesquiplane amphibian, and the lower one the Darmstadt D.22 cantilever biplane. Photographs by courtesy of Blériot-Aéronautique, and the Darmstadt University Aviation Society, respectively.

The Darmstadt D.22, constructed by the Darmstadt University Aviation Society, is another type of which no example is built in this country. It is a cantilever biplane, a notable feature of which is that all the usual system of struts and bracing wires is dispensed with. The machine is also given a striking appearance by the fact that the wings have a pronounced forward stagger, or in other words, the upper wing is situated well in front of the lower one. The absence of struts and wires has an appreciable effect upon the speed of the machine, as it lessens its drag or wind resistance; and it also reduces considerably the amount of work required to "rig" the machine. These features have been made possible by the use of cantilever wings built on a similar principle to that which governs the construction of cantilever bridges. This means that the stresses on one half of the plane are not carried to the

fuselage by the "flying wires" in the usual manner, but are mainly compensated by stresses on the other half of the plane.

The cantilever method of construction is employed on many aeroplanes, in particular on a large number of Fokker machines; but it is very rarely employed in biplanes, and it is probable that the Darmstadt types are the only examples at present in existence. The D.22, the latest of these, is a two-seater light aeroplane, 21 ft. 2 in. in overall length and with a span of 24 ft. 3 in. These measurements also are unusual, for the span of a biplane is generally much greater than the length. The machine is fitted with an "Argus" As8R inverted four-cylinder-in-line air-cooled engine that develops 150 h.p., and has a maximum speed of about 149 m.p.h. and a cruising speed of 136.6 m.p.h. The previous Darmstadt cantilever biplane, the D.18, set up a world's speed record for its class when equipped with an Armstrong Siddeley "Genet" engine.



One of the world's fastest aeroplanes, the Gee-Bee "Super-Sportster." In September 1932 this American machine set up a record for landplanes by travelling at a speed of 294.2 m.p.h.

It is interesting to note that the Darmstadt University Aviation Society is not a commercial firm of aeronautical constructors, but is a society composed of students from the Darmstadt Technical High School, who gain practical experience by building aeroplanes of their own design. The first machines constructed were gliders and sailplanes, and some very famous ones, which had a great effect upon German sailplane design, were built. The first powered aeroplane to be constructed by the Society was the "Mahomed," built in 1924, which secured several prizes in competitions.

The Gee-Bee "Super-Sportster" is the most unusual of the machines illustrated in this article. The fuselage is extremely fat and short, while the rudder, tailplane and elevators are very small. The most remarkable feature however is the fact that the pilot's cockpit is situated as far in the rear as it is possible for it to go, the pilot actually sitting level with the leading edge of the tailplane. This position is employed in order to off-set the weight of the huge Pratt and Whitney "Wasp" supercharged engine with which the machine is equipped. When the pilot gets into the cockpit a cover is closed down on him and held in position by special fasteners, arranged so that they can be quickly released if necessary. In an emergency the pilot would pull a special lever, and the cover and the top cowling of the fuselage over the cockpit would be released in one movement, allowing the pilot an unobstructed passage to escape by parachute.

The machine was built for the 1932 National Air Races, an important aeronautical event that takes place in the United States every year; and it follows the same general lines as other Gee-Bee machines that have been produced previously for these races. Some idea of the success that has attended the efforts of the engineers responsible for this bullet-like machine may be gained from the fact that on 3rd September, 1932 a world's speed record for landplanes was set up in it by Mr. James Doolittle, the well-known American pilot, who flew at a speed of 294.2 m.p.h. This record does not still stand, however, having been beaten in September of this year by Mr. James Wedell, during the International Air Races held at Chicago, in connection with the "Century of Progress" Exhibition. This American pilot flew a Wedell-Williams monoplane equipped with a Pratt and Whitney "Wasp" engine at an average speed of 305 m.p.h. over a marked and officially observed course.

Full details of the "Super-Sportster" are not yet available for publication, but it can be stated that the machine is only 25 ft. in span, and 17 ft. 9 in. in overall length. The "Wasp" engine with which it is equipped develops 800 h.p. at 2,350 r.p.m., and is 800 lb., or nearly half a ton in weight. The machine weighs 1,840 lb. when empty, and 3,075 lb. when fully loaded. It is fitted with fuel tanks that have a total capacity of 160 U.S. gallons.

There is another version of the "Super-Sportster," equal in size to the one just described, but equipped with a supercharged Pratt and Whitney "Wasp-Junior" engine, developing about 550 h.p. This machine is capable of carrying 302 U.S. gallons of petrol, and has attained a speed of 247.3 m.p.h. over an official 3 km. course.

A Junkers "Junior" all-metal light aeroplane in flight. The familiar Junkers practice of employing corrugated metal can be seen in this illustration. Photograph by courtesy of Junkers-Flugzeugwerke, A. G.

The Junkers "Junior" is one of the best-known low wing monoplanes. It is only a light machine, but it has to its credit a large number of excellent flights in all parts of the world. It is not unique in design, similar machines being built in England; but with the exception of the Avro "Avian Monoplane," the British low wing monoplanes are cabin machines and have seats for at least three people. The "Junior" is an all-metal machine, fitted with cantilever wings similar in principle to those on the Darmstadt, and 32 ft. 10 in. in span. It may be equipped with an Armstrong Siddeley "Genet" engine developing between 80 and 88 h.p., or with a Siemens Sh.13a five-cylinder radial air-cooled engine, according to personal wishes. It is 23 ft. 6 in. in overall length, and has a maximum speed of 109 m.p.h., a cruising speed of 87 m.p.h. and a landing speed of 46 m.p.h.

The founder of the firm of Junkers Flugzeugwerke A.G. was Professor Junkers, another of the pioneers of aviation. He was the inventor of the opposed piston Diesel engine, and in 1909 patented a novel form of thick wing cantilever aeroplane. In 1915 he founded the firm that bears his name, to introduce new ideas and to develop all-metal aeroplanes fitted with cantilever wings.

Probably the most famous aeroplane produced by Professor Junkers is the G.38, which is claimed to be the biggest landplane in the world and is in regular operation on the London-Berlin service. This machine was fully described and illustrated on page 972 of our issue for December, 1931.

XLVIII.—A PHOTO-ENGRAVER

PRINTING of a kind existed in Europe long before the time of Gutenberg and Coster, to whom we referred in last month's article in this series, dealing with the career of a printer. Many of the books produced at this early period contained remarkable illustrations. The characters or pictures to be reproduced were marked out on the surface of a block of wood, which was then cut away so as to leave the required print standing up above the level of the rest of the block. Impressions were then made by inking the blocks and pressing sheets of paper on them. Block-cutting in this manner was a very laborious process, and "block books," as they were called, were rare and highly prized.

The production of block books interests us now chiefly because wood engravings were still in use until about 50 years ago. Naturally many improvements had been introduced since the invention of the method, notably in the use of better ink and of a more suitable wood. The engravers of last century worked on boxwood, which is not only hard, but of extremely fine grain so that it can be cut cleanly in any direction. The introduction of photography brought about a complete change, for drawings were then made on paper and photographed on the wood. This was a great improvement in many respects, and in particular, pictures could be drawn any size and reduced or enlarged as required when they were being photographed in readiness for the engraver.

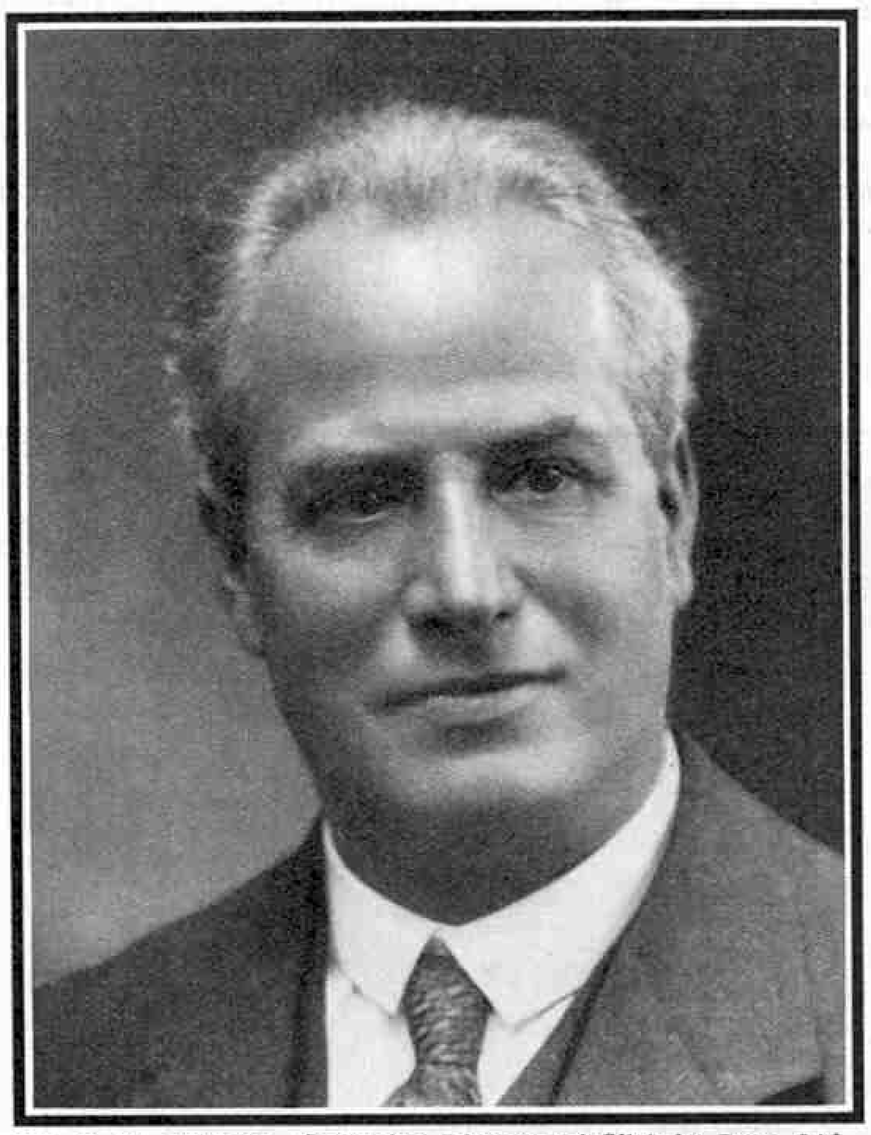
Not long afterwards the use of wood engraving was abandoned. Metals such as copper and zinc came to be employed instead of boxwood, and the laborious graving process was replaced by etching with acids. The splendid illustrations that appear on the pages of the "*M.M.*" are printed from blocks of these metals upon which pictures have first been photographed and afterwards engraved by chemical methods.

As a general rule a boy who wishes to become a photo-engraver enters into an apprenticeship with some firm in his town or district. A good general education is an essential preliminary, and many firms insist that all boys who propose to become apprentices should have attended a secondary school and passed a Matriculation examination or obtained the School Certificate A. Other firms only require a boy to have attended a secondary school, and rely upon a personal interview to discover whether he has the necessary educational qualifications.

The age at which a boy becomes an apprentice depends to a large extent on the type of school that he attends. If he has received his education at an elementary school he will leave school when he is about 14 years of age, and if he is successful in obtaining a position immediately there will be two years to find out whether he is gifted sufficiently to be successful in one of the several departments of the trade. If this turns out to be the case, when he reaches the age of 16 he must then be apprenticed, and must serve indentures for five years.

If the boy has attended a secondary school he will not leave until he is about 16 years of age, and consequently he will not have much opportunity of a probationary period in which to find out if his temperament and talents are suitable for the branch in which he enters. By agreement between masters and men, a boy over 16 cannot be employed in the trade unless he is an indentured apprentice, and therefore it is important that any boy who wishes to become a photo-engraver should not remain at school until he is more than 16, for he will find that few, if any, engravers will accept an apprentice who is above that age. Because of this, the boy should begin to think seriously about his career a good while before leaving school, and should not wait until his school days are definitely behind him before seeking an opening. Most photo-engraving firms of standing do not require premiums to be paid.

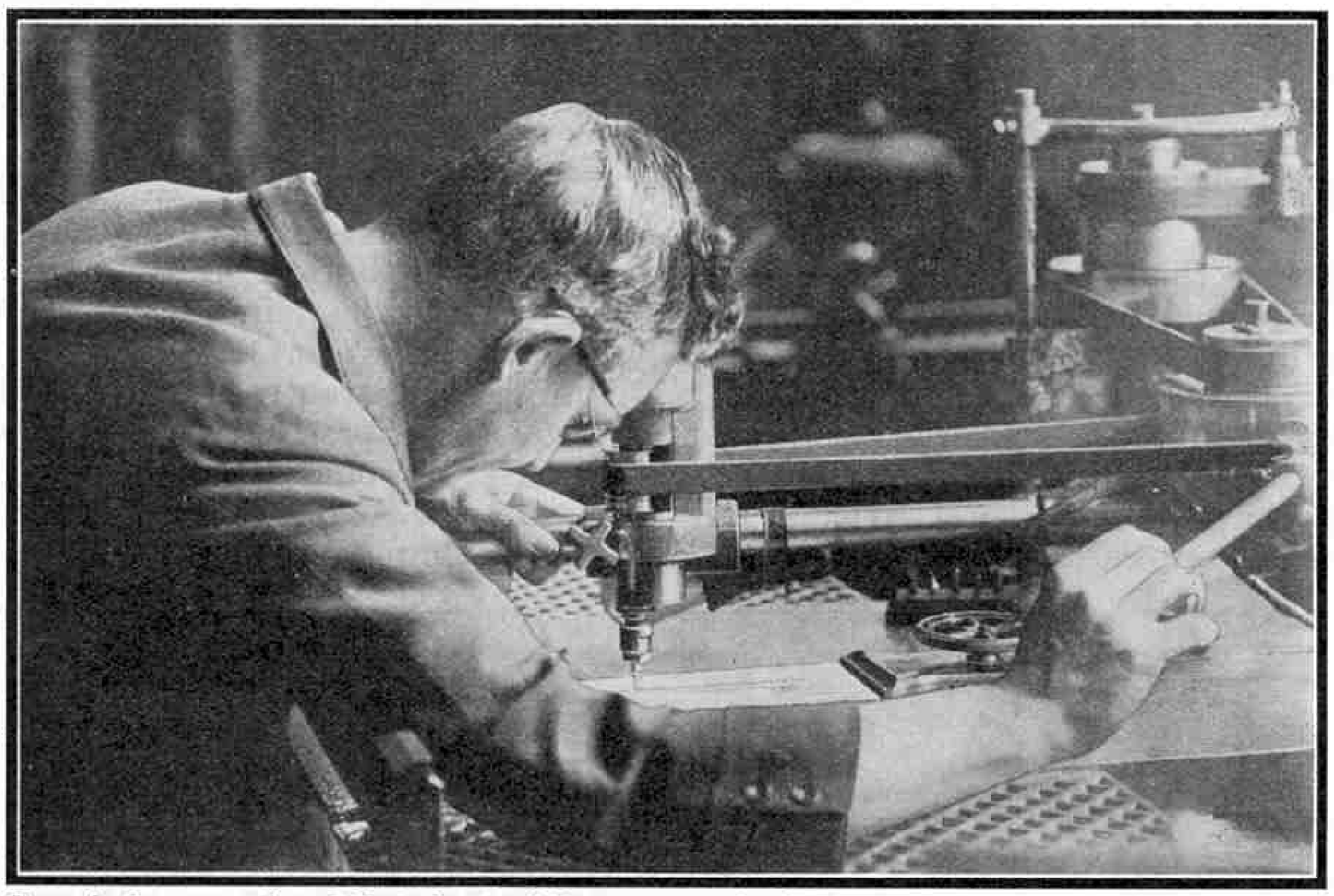
It is sometimes possible for a boy who can afford the necessary fees to attend a course of technical instruction in photo-engraving before he actually enters the trade. If this plan can be followed it is an excellent one, as it enables a boy to take fuller advantage of the practical training he will receive while at work. A course of this nature is available at the Schooi of



Mr. C. W. Gilchrist, Governing Director of Gilchrist Bros. Ltd., Leeds, who make all the blocks that are used in the "Meccano Magazine." He was apprenticed as a photo-engraver in 1888, and throughout his career has been keenly interested in improving the various methods of producing printing blocks. He was the first in this country to introduce electrically etched half-tones.

Photo-Engraving and Lithography, London. Here instruction is provided in purely trade work, and in addition scientific and artistic training is given. Admission of fee-paying pupils is restricted as a rule to boys not under 13 and not over 14½, although in special cases suitable boys whose ages are a little outside these limits may be admitted.

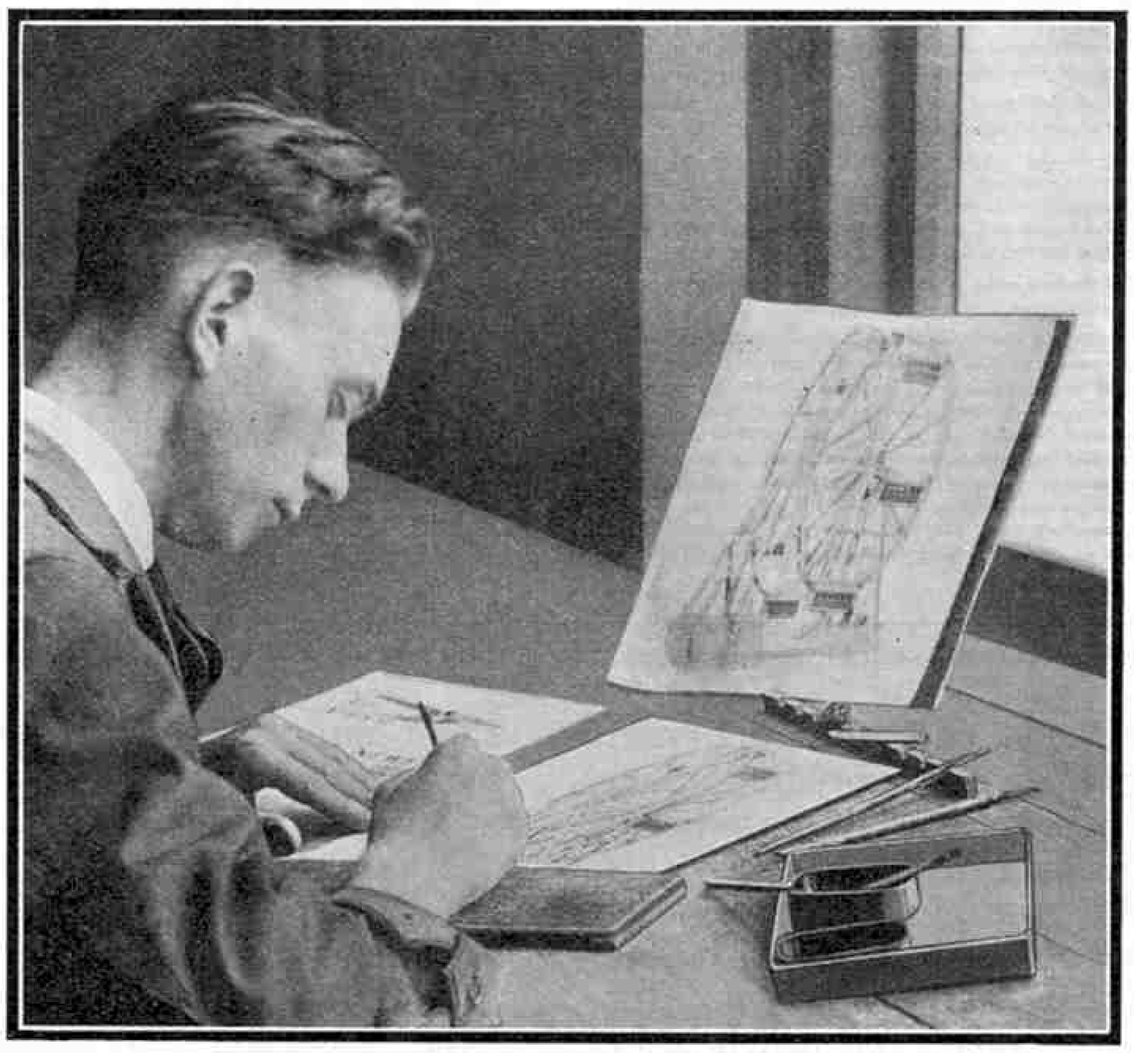
Wages vary in different parts of the country and with different firms, but as a rule a boy of 15 on first taking up an apprenticeship may expect to receive about 10/- per week. This increases annually until, when he has really completed his apprenticeship but is still not 21, and is therefore working as what is termed an "improver," he will probably be receiving £2 per week. On finishing his time and obtaining work as a fully qualified tradesman, a weekly wage of £4 8s. 0d. may be expected, rising to £5 or more according to ability.



Stages in the preparation of blocks for the "Meccano Magazine." Routing a completed plate, or cutting out unwanted metal from it, in readiness for mounting.

When a boy has been engaged with a view to apprenticeship, the decision has to be made in which branch of the business he shall receive his training. There are nine distinct departments, and it is the rule nowadays that each department shall be staffed by specialists, who are trained to make the plate ready to be taken up by the next department, until the block is finally completed. Thus a boy's duties vary according to the department in which he is placed.

We may, however, instance a boy going into the operating studio, where the negatives are made from which the blocks are produced. He will first be shown how to mix the various chemicals required for the production of the negative, and he will be shown how the negatives are developed and finished in readiness for the next stage, which is the printing-down on the plate. He will then be shown the workings of the process camera, and how the exposures have to be made through a ruled screen. If he makes good progress he will be given an opportunity to expose a plate in the camera, and to develop and finish it off through its various stages, until he is able to produce good class negatives. Thus a boy interested in chemistry is likely to be more successful in this department than if put to the mechanical side of the business, which is routing and mounting. Temperament and inclination for the artistic or mechanical side must be taken into consideration when making the decision as to which branch the boy should enter.



One of the final processes. Parts of the plate are being covered with protective material before it is returned to the etching machine.

It must be understood that the business is of an involved nature and cannot be treated lightly. A full five years' apprenticeship is necessary to enable a boy to become quite proficient at the age of 21, so that he can go out into the trade as a fully qualified craftsman.

Most firms of photo-engravers insist that all their apprentices should attend evening classes. Suitable classes are held in technical institutes and art schools in most parts of the country, and full information can be obtained from the secretary of the local Education Committee. Some of these schools have special examinations of their own for which students are required to sit at the end of each session; others prepare students only for the examinations held by the City and Guilds of London Institute. These examinations are intended primarily for the apprentice in his later years, or for the qualified craftsman who is improving his knowledge by attendance at part-time courses. The apprentice's course is arranged to cover normally a period of four years, divided into two periods of two years. There is an intermediate examination at the end of the second year, and a final examination at the end of the fourth year.

Prior to entering on the first year of technical instruction, it is desirable that a student who has left a public elementary school at the age of 14 should have attended for two years a part-time junior or preliminary technical course, including English, calculations, drawing and elementary science, such as is provided in many evening institutes and technical schools.

It is expected that students who wish to sit for the two examinations should attend classes on at least two evenings per week, but

(Continued on page 884)

The New Patent Act

Changes That Affect Inventors

By Bertram T. King

ON 1st November last there came into force the Patents and Designs Act 1932, which effected certain changes in the law relating to inventions and industrial designs. The general method of obtaining a patent was fully described in the "*M.M.*" for June, 1928, and readers who are interested are advised to obtain a copy of this issue (price 8d. post free). The new Act makes numerous alterations, and it is only possible to deal with a few of them in this short article.

The period of provisional protection under the new Act is extended by three months, so that the Complete Specification may now be left at any time within 12 months from the date of the application. This period is the same as that allowed in which to file applications abroad under the International and Intercolonial Arrangements, so that if the Complete Specification is not left until the end of the period allowed, and if foreign patents are contemplated, then the foreign applications will have to be despatched before the Complete Specification is on the file in this country. Further, unless the Complete Specification following the Provisional Application is left well before the expiration of the 12 months, the search on novelty made by the Patent Office, the result of which very often influences the applicant's decision with regard to foreign patents, will not be available.

A very important change concerns the search made by Patent Office officials to determine to some degree whether an invention sought to be patented is novel. Formerly the official search was directed to the investigation of previous British patent specifications filed on applications for patents during the previous 50 years. Under the new Act the search may be extended to foreign specifications and other documents. The widening of the search brings the English practice more into line with that prevailing in Germany and the United States, but the fact that a patent is granted is still no guarantee of its validity.

It is anticipated that greater work will be involved in carrying out the more extensive search directed by the new Act, and the time for obtaining acceptance of the Complete Specification has been extended to 18 months from the application date. The Government fees on filing a Complete Specification have also been increased.

The time in which a patent must be sealed has been extended from 18 months to 21 months, so that under the new Act the maximum time within which the patent must be sealed, including extensions of time obtainable under the Principal Act, is 28 months. This period may be extended by such an amount as appears to the Comptroller to be necessary, if it is proved that hardship would arise in connection with a patent application outside the United Kingdom.

Many new grounds on which application may be made by petition to the Court for revocation of a patent have been added. These new provisions are of considerable importance, and they certainly make it more than ever necessary to obtain professional assistance in preparing a Complete Specification for Letters Patent.

In the past patents have been granted for so-called perpetual motion machines and other similar contrivances that obviously would not work. The new Act empowers the Comptroller to refuse to grant a patent on what he regards as a frivolous application. This is a wise alteration because, unfortunately, ignorant and ill-informed inventors and purchasers have on various occasions wasted a good deal of money on patents of this kind.

A.D. 1913. A¹

No. 22962.

GEORGE V. BY THE GRACE OF GOD,

Of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, Emperor of India: To all to whom these presents shall come greeting:

WHEREAS Frank Hornby of 274 West Derby Road, Liverpool, Manufacturer

hath declared that he is in possession of an invention for Improvements in couplings or the like devices for shafts, rods, axles, or the like

that he claims to be the true and first inventor thereof, and that the same is not in use by any other person to the best of his knowledge and belief, and that the said invention is an improvement in or modification of his invention for which a patent was applied for on the eleventh day of September one thousand nine hundred and thirteen and numbered 20535 and on which a patent (hereinafter called the original patent) has been granted for which he was the applicant:

AND WHEREAS the said inventor hath humbly prayed that a patent might be granted unto him for the sole use and advantage of his said invention:

AND WHEREAS the said inventor (hereinafter together with his executors, administrators, and assigns, or any of them, referred to as the said patentee) hath by and in his complete specification particularly described the nature of his invention, and has requested that the term limited in such patent for the duration thereof be the same as that of the original patent or so much of that term as is unexpired:

AND WHEREAS We, being willing to encourage all inventions which may be for the public good, are graciously pleased to condescend to his request:

KNOW YE, THEREFORE, that We, of our especial grace, certain knowledge, and mere motion do by these presents, for us, our heirs and successors, give and grant unto the said patentee our especial license, full power, sole privilege, and authority, that the said patentee by himself, his agents, or licensees, and no others, may at all times hereafter during the term of years herein mentioned, make, use, exercise, and vend the said invention within our United Kingdom of Great Britain and Ireland, and Isle of Man, in such manner as to him or them may seem meet, and that the said patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention, during the term of fourteen years from the eleventh day of September one thousand nine hundred and thirteen being the date of the said original patent

No. 20535 or so much of that term as is unexpired: AND to the end that the said patentee may have and enjoy the sole use and exercise and the full benefit of the said invention, We do by these presents for us, our heirs and successors, strictly command all our subjects whatsoever within our United Kingdom of Great Britain and Ireland, and the Isle of Man, that they do not at any time during the continuance of the said term either directly or indirectly make use of or put in practice the said invention, or any part of the same, nor in anywise imitate the same, nor make or cause to be made any addition thereto or subtraction therefrom, whereby to pretend themselves the inventors thereof, without the consent license or agreement of the said patentee in writing under his hand and seal, on pain of incurring such penalties as may be justly inflicted on such offenders for their contempt of this our Royal command, and of being answerable to the patentee according to law for his damages thereby occasioned:

PROVIDED ALWAYS that these letters patent shall be revocable on any of the grounds from time to time by law prescribed as grounds for revoking letters patent granted by Us, and the same may be revoked and made void accordingly: PROVIDED ALSO, that if the said patentee shall not pay all fees by law required to be paid in respect of the grant of the said original letters patent, or in respect of any matter relating thereto at the time or times, and in manner for the time being by law provided; and also if the said patentee shall not supply or cause to be supplied, for our service all such articles of the said invention as may be required by the officers or commissioners administering any department of our service in such manner, at such times, and at and upon such reasonable prices and terms as shall be settled in manner for the time being by law provided, then, and in any of the said cases, these our letters patent, and all privileges and advantages whatever hereby granted shall determine and become void notwithstanding anything herein before contained: PROVIDED ALSO, that nothing herein contained shall prevent the granting of licenses in such manner and for such considerations as they may by law be granted: AND lastly, we do by these presents for us, our heirs and successors, grant unto the said patentee that these our letters patent shall be construed in the most beneficial sense for the advantage of the said patentee.

IN WITNESS whereof we have caused these our letters to be made patent and to be sealed as of the eleventh day of October one thousand nine hundred and thirteen.

W. TEMPLE FRANKS,

Comptroller-General of Patents, Designs, and Trade Marks.

The much-prized document—the sealed letters patent, as granted to an inventor—which may bring him fame and fortune—or may not!

A Famous Cricketer Pays Us a Visit

He Wishes Every Boy Could See the Meccano Factory

AMONG the many distinguished visitors whom it has been our privilege to welcome at the Meccano Factory, few occupy so high a place in the esteem and affection of boys as Mr. J. B. Hobbs, the famous Surrey and England batsman, who visited us on Friday, 8th September.

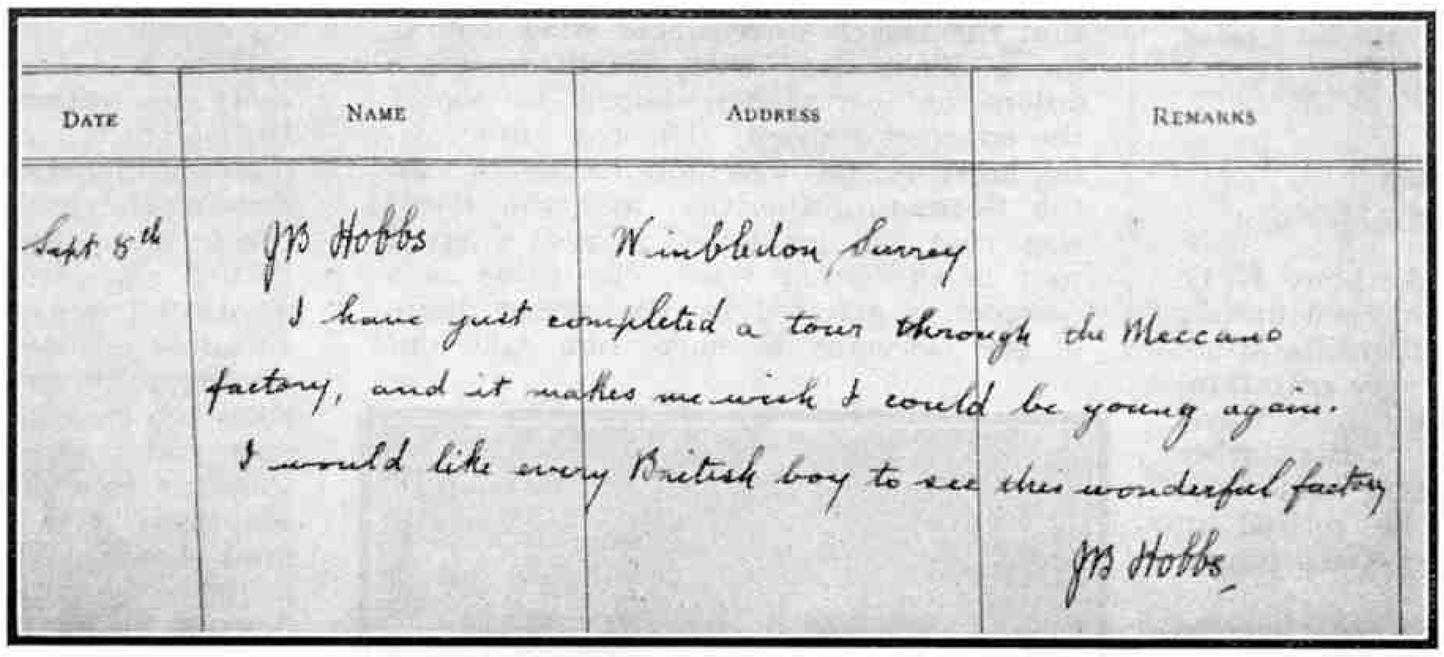
"Jack" Hobbs, to use the name by which he is known throughout the cricket world, although now nearing the close of his 51st year, retains a youthfulness that makes it difficult to realise that for nearly thirty years he has been a "star" in English cricket. His fitness augurs well for the completion next season of a record that is likely to stand for all time—the scoring of 200 centuries in first-class cricket.

Hobbs is a son of the late J. C. Hobbs, professional cricketer on the ground staff at Fenner's, Cambridge, and he played for Cambridge as an amateur. After professional engagements at Bedford Grammar School and at Cambridge, he was taken on by the Surrey Club in 1903, and two years later went into the Surrey County Team.

In referring to the exploits of Hobbs it is difficult to know where to begin, for he has set up so many records. There is, for instance, his first-wicket partnership with the great Yorkshireman Wilfred Rhodes, in the England–Australia test match at Melbourne in the 1911–12 tour, which realised 323 runs. With another famous Yorkshire player, Herbert Sutcliffe, he shares the record first wicket stand against the South Africans, 268 in the Lords match in 1924.

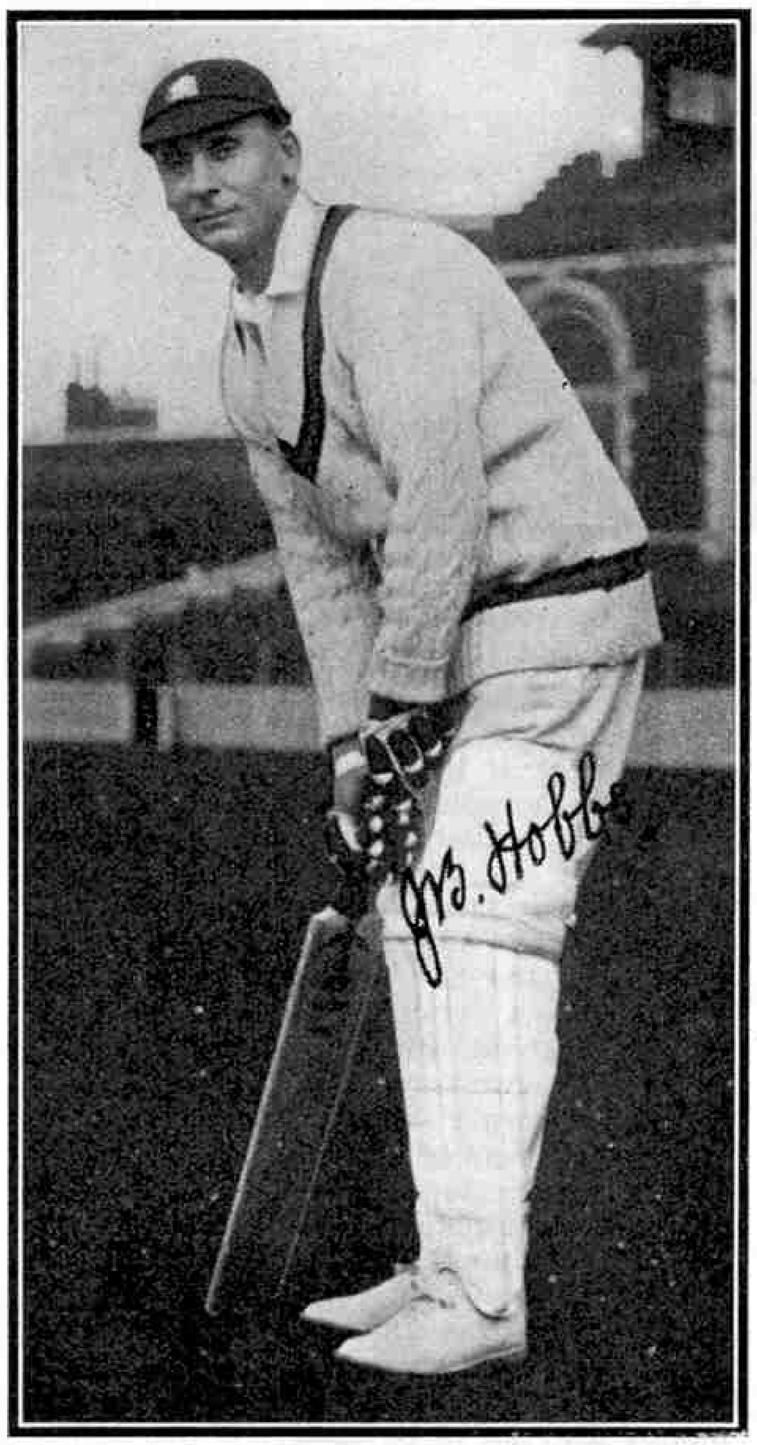
In all, Hobbs has played seventy-one Test Match innings, totalling 3,636 runs for an average of 54.26 runs. His biggest Test Match score was 187 at Melbourne in the 1911–12 game. Melbourne seems to have been Hobbs' happy hunting ground, for of twelve test match centuries against Australia, five have been scored here. Hobbs' record score in first-class cricket is 316 not out against Middlesex in 1926, and in the previous season he achieved his highest season's aggregate, 3,024 runs.

Since his first appearance for the county of Surrey, Hobbs has scored 61,629 runs in first-class cricket; that is over 11,000 more runs than any of his contemporaries, and nearly 7,000 more than the total achieved by the renowned Dr. W. G. Grace. This striking achievement makes a curious commentary on the views of those who would restrict county cricket elevens to native-born players. Such a restriction would have compelled Hobbs to live his cricket career in the comparative obscurity of the Minor Counties.



DATE	NAME	ADDRESS	REMARKS
Sept 8th	J B Hobbs	Wimbledon Surrey	I have just completed a tour through the Meccano factory, and it makes me wish I could be young again. I would like every British boy to see this wonderful factory. J B Hobbs

Jack Hobbs' entry in the Visitors' Book at the Meccano factory.

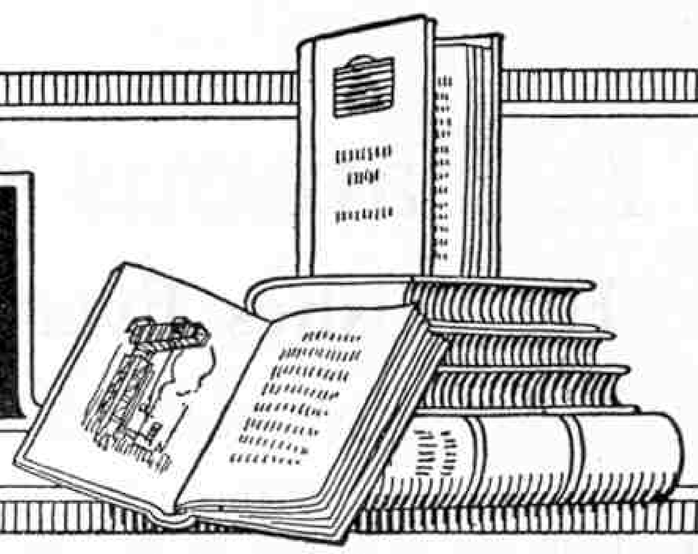


Ready for another century. Jack Hobbs' comfortable, alert stance at the wicket is one of the secrets of his great success.

It is in the nature of things that hero worship comes to those whose prowess can be recorded in big figures, and these achievements are apt to dwarf the hero's performance in other directions. It is interesting to add, then, for the encouragement of those readers whose batting is not of rock-like consistency, that Hobbs would have been known in cricket history as a great fielder even if he had not won fame as the world's greatest batsman. The game has known few better cover points. If one could add the runs he has saved to those he has made, what a total they would make!

Hobbs was escorted round the factory by Mr. Douglas Hornby, and throughout the tour he displayed the keenest interest in everything he saw, maintaining an almost ceaseless fire of questions regarding the operations. At the conclusion of the tour he expressed his appreciation in the enthusiastic entry in the Visitors' Book reproduced above, which we are sure will be read with interest by all Meccano boys.

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"Flying Dutchman"

By ANTHONY FOKKER. (Routledge. 6/–)

In "*Flying Dutchman*," Anthony H. G. Fokker has written a book that is definitely among the classics of aeronautical literature. In it the story of his life is very entertainingly told right from his early days, which were spent in Java. His father was a wealthy coffee planter and went home to Holland when he retired in order to enable the boy to receive a proper education.

Fokker was most decidedly not a success at school, and even his invention of an "examination passer," on which answers were marked on a revolving cardboard disc visible only through a slit in his desk, did not help him to achieve great distinction in ordinary school work! He was greatly interested in handwork, however, and in a workshop created in an attic in his home he gave full rein to his inventive genius. In order to prevent unwelcome intrusions from members of the family, he connected up a shocking coil with the knob on the door of his room. He writes that "the first victim was an inquisitive cousin, who thought she would peek into my funny attic. The family heard her frantic yells and rushed upstairs to find her dancing ecstatically up and down before my door with her hands glued to the knob. That cured everyone of calling on me without an express invitation."

Another of Fokker's curious labour-saving inventions was a piece of wood to hold four pens to enable him to write four "lines" at once. Often also he paid boys to write the "lines" he had earned, while he went out sailing his home-made boat or worked in his workshop in the attic.

During his early years Fokker made numerous experiments with paper gliders such as boys still use at school, and later was so inspired by the exploits of the Wright Brothers and other early airmen that he decided he must "get into aviation." The first school to which he went in order to learn to fly came to an untimely end when the aeroplane was crashed by the so-called instructor, who knew little or nothing about aviation, Fokker demanded the return of the fee paid by his father for the course, and with this, and other money borrowed from his father, he commenced to build his first aeroplane. This was duly completed and was successfully flown by Fokker, but unfortunately while he was at home recovering from an attack of pneumonia, contracted during his flights, his partner tried to fly the machine and crashed badly.

Fokker later built another machine and in this made a large number of flights. He established his base at the flying field at Johannisthal, near Berlin, and, knowing that the Dutch Government were looking for a constructor with whom to place orders for aeroplanes, hoped to secure the contract himself. He was unsuccessful, however, but was more fortunate with the German authorities, and the result was that his machines played a great part in the Great War. His value as a designer is attested by the strong desire of the Germans to make him take out

Anthony H. G. Fokker, the famous inventor and aviator who describes his career in "Flying Dutchman" reviewed on this page.

naturalisation papers, and also by the story, given here for the first time, that he was offered £2,000,000 by the British Government if he would leave Germany and make aeroplanes in England.

What is probably the most interesting chapter in the whole book deals with a problem that faced him at the end of the War, when the Allies ordered every Fokker aeroplane to be destroyed. He then smuggled six train loads of material, including about 400 engines, 120 single-seaters, 60 two-seaters, and about 20 of the well-known Fokker D.8 type machines over the borders of Germany into Holland. He managed to conceal some of the money he had made and he reveals the fact that at one time during the Revolution he carried it about with him in a battered suitcase, and was constantly protected by a personal bodyguard of four stalwart marines. Eventually he smuggled this money also out of Germany.

Every boy who is at all interested in flying should read this book, for it is the story of the adventures of a remarkable man.

"British Ships Illustrated"

By A. C. HARDY, B.Sc. (Black. 3/6)

Here is a book with illustrations and short descriptions of forty-three different British merchant ships, most of them representing entirely different types and showing the result of the changes that have taken place during the last decade in British ships and shipping. The vessels illustrated are those that compose our all-important mercantile marine, and the photographs have been carefully chosen to show the vessels in their natural surroundings and connected with the work that they are intended to perform. All types are dealt with, from large liners, Cape mail boats, West African traders, refrigerator ships, cross-Channel ships, down to the humble collier and fishing craft.

Mr. Hardy is an acknowledged authority on matters connected with ship-types and ship propulsion and in the text he gives us the benefit of his wide experience of shipping matters. His introduction clearly summarises the present position of British shipping with regard to the methods of propulsion employed and the various types of machinery in general use. All the principal systems are discussed and illustrated and the outstanding features in every example are emphasised.

It is interesting to learn that Mr. Hardy believes that the oil-using ship is destined to play a tremendously important part in years to come. He thinks that it is difficult to conceive in the future that coal can occupy a position of great importance except for purely local services. In his opinion "the British mercantile marine is at the present moment probably in a better technical position than ever to meet the often subsidised competition of foreign nations, but it will not remain so unless every effort is made to maintain it on a basis of the highest possible efficiency from a propulsive point of view."

The illustrations, which are beautifully produced in photogravure, are as striking as they are picturesque.

"Five Plays for Scouts"

By H. E. & N. I. NICHOLLS
(Brown, Son & Ferguson Ltd. 1/6 net)

The presentation of simple plays forms an attractive feature of the lighter side of Scout life, and the present book contains five plays suitable for production at Scout concerts and similar social gatherings. They vary in length and in character, but all can readily be performed with the aid of simple and inexpensive scenery and equipment. The subjects of the plays range from adventure on a cannibal island in the South Seas to struggles with burglars and kidnappers, and many dramatic surprises await the villains at the hands of Scouts, who of course figure prominently throughout. When performed with spirit the plays will provide excellent entertainment both for the players and for their audiences.

"At Home Among The Atoms"

By Professor JAMES KENDALL, M.A., D.Sc., F.R.S.
(Bell. 4/6 net)

Professor Kendall describes his book as "A First Book of Congenial Chemistry," a sub-title carefully chosen to indicate its informal character. He recognises that to-day there are many people who realise how great a part chemistry plays in human life, and wish to know and understand something of the work of the chemist, and his book gives them the necessary information clearly and authoritatively. It is written so entertainingly that from beginning to end it holds the attention of the ordinary reader, whose progress is made easy by means of homely analogies and humorous explanations. It will throw a new light on chemistry for those who already know something of this great science, and owners of Kemex Outfits will find it specially useful in enabling them to grasp the ideas behind their experiments.

The chemist is concerned with the nature of the things, or "substances," as he prefers to call them, that he finds in the air, the earth and the sea, or is able to make for himself in his laboratory. The author begins by explaining the means that have revealed the nature of these substances, choosing familiar examples of chemical change, such as rusting and burning, in order to make the purpose of chemical experiments clear. Then he shows how patient analysis has revealed the presence of about 90 simple substances in the 300,000 different chemicals described in modern chemical dictionaries. These simple substances are known as elements. Some of these are more abundant than others, and most of them are so rare that 99 per cent. of the earth is composed of only 12 elements. It is interesting to read that practically half of our planet consists of oxygen, the familiar gas present in the atmosphere and found in combination with other elements in water and many common rocks.

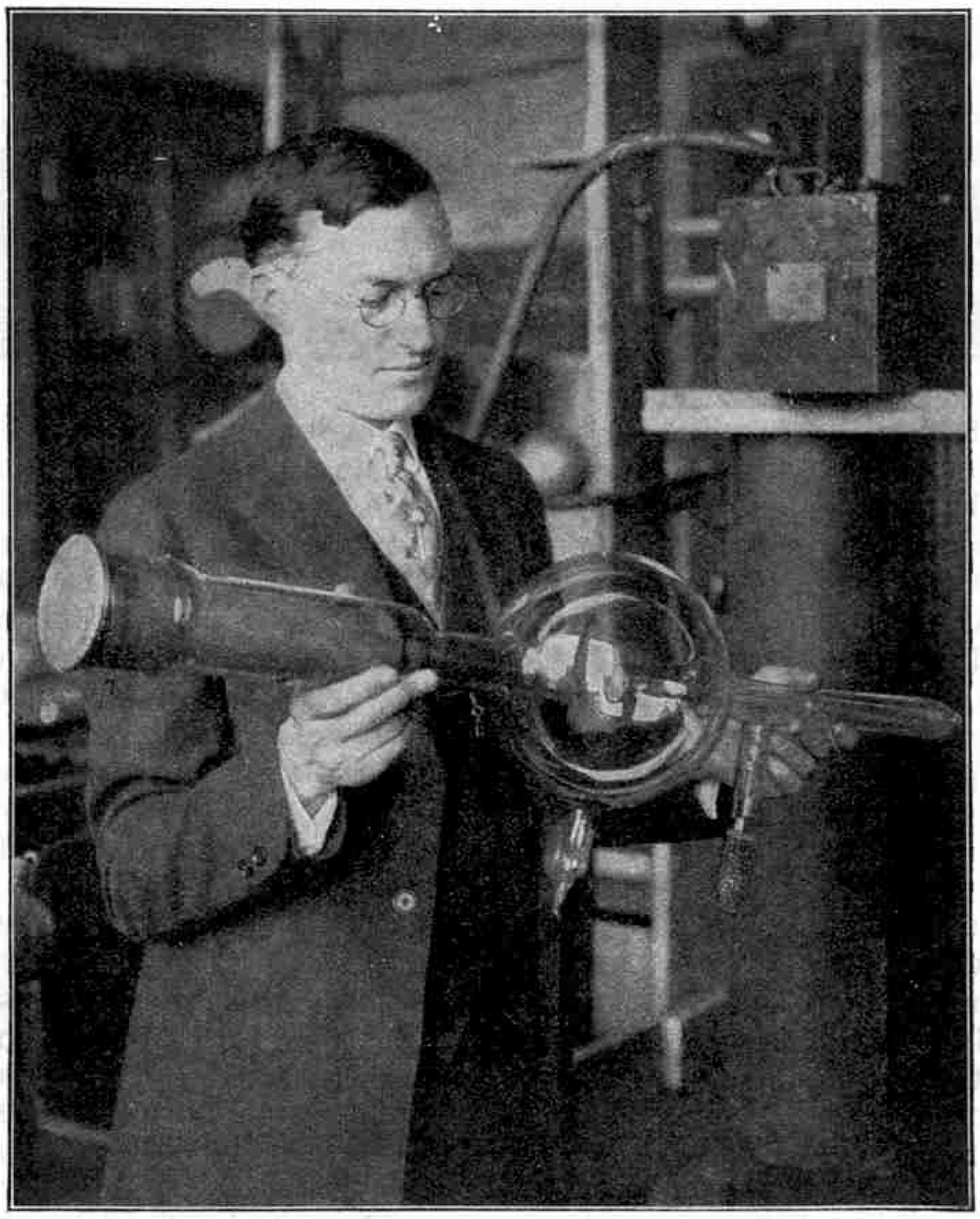
This simplification is followed by an account of one of the most important tasks of the chemist—that of finding how the elements unite with each other. This involves a little arithmetic. The amount required is not more than sufficed for Christopher Robin and Pooh in Mr. A. A. Milne's charming and well-known rhymes, but in Professor Kendall's skilful hands is sufficient to reveal the atomic structure of matter. His readers learn how by similar means Dalton, the famous English chemist, came to realise about 125 years ago that every element is built up of tiny particles, those of any one kind of simple substance being of the same weight, and having the same likes and dislikes for the particles of other elements. These particles are the atoms, or bricks of the universe, and chemists have weighed and measured them with extraordinary accuracy.

Professor Kendall then introduces his readers to the more important of the elements. Such well-known performers in the chemical world as oxygen, hydrogen, and chlorine are dealt with, and their stories are told in a light and easy manner that helps to convey to the reader the wonderful fascination of chemical science.

The author then touches upon the rarer elements, the strange properties of which have greatly influenced chemical ideas. These include helium, neon and other inert gases that lurked in our atmosphere undetected until about 40 years ago, by which time one of them had actually been discovered in the Sun! Special consideration is given to radium and similar elements that are slowly committing suicide by shooting out various kinds of particles and rays, for their discovery was the beginning of a tremendous upheaval in science, and its effect on chemistry, as told by Professor Kendall, makes a story of absorbing interest.

Finally we come to recent developments of our ideas of atoms. Scarcely had chemists begun to weigh and measure the atoms of the elements known to them when an uneasy suspicion arose that after all these were not the simplest forms of matter. For a century authorities frowned upon this suspicion, but at length it was proved to be well-founded. The truth was a distinct surprise, however, for it was found that the atoms of the elements were built up of two kinds of particles, that are now known respectively as electrons and protons. The electron is a unit of negative electricity. The proton is a much heavier particle carrying a positive charge. Both are far too small to be visible, even with the aid of the most powerful microscope, and in order to enable his readers to realise how small they are, Professor Kendall asks them to "imagine a hydrogen atom magnified until it became as big as the Wembley Stadium. The nucleus would then be equivalent in size to a golf ball in the centre, while the electron might be represented by a man in an aeroplane circling over the top ring of seats." The comparison also reveals the startling fact that an atom is mainly emptiness! Even the most solid objects familiar to us are in reality composed of tiny protons and electrons widely separated from each other.

These discoveries led chemists to picture the atoms as combinations of protons and electrons held together by their electrical attractions for each other. Then it was suggested that they resembled miniature solar systems of varying degrees of complexity, the electrons whirling in orbits round the protons that formed their nuclei. It now seems that in its turn this picture will be superseded by one in which there are no material atoms at all, their places having been taken by groups of waves, which the author describes as "electrical holes in the centre of auras," or vibrating halos. At present these ideas are in opposition to each other, for neither gives us a complete and satisfactory picture; and the author suggests that eventually some scientific genius will discover means of combining them to form a more satisfactory representation of the true condition of the interior of the tiny particles we call atoms.



Modern Cathode Ray Tube of the type introduced by Dr. W. D. Coolidge. From "At Home Among the Atoms" reviewed on this page.

"British Locomotives Illustrated"

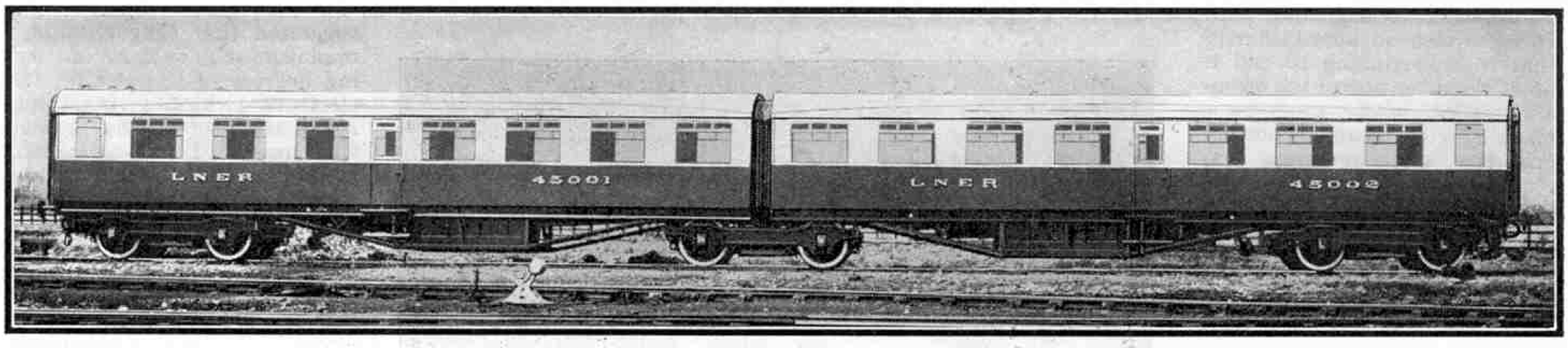
By W. J. BELL, M.I.L.E.
(Black. 3/6)

The endeavour here is to give the clearest possible reproductions of first-class photographs of representative modern British locomotives. Although the main idea is to show the tendency in modern design, several illustrations of early engines are included by way of contrast. These serve to indicate the lines on which the modern locomotive has evolved from the locomotives of early days. Each illustration is faced by an informative descriptive note. A brief introduction outlines railway developments from the "*Rocket's*" first trial to the present day, and the illustrations include the latest types of engines on British railways, as well as lesser known locomotives. In the latter category is the three-cylinder Pacific type "*Hurricane*" on the 15 in. gauge Romney, Hythe, and Dymchurch Railway. Among the historic engines are the G.W.R. "*City of Truro*" and the famous "*Gladstone*" of the L.B.S.C., both of which are now housed in the York Railway Museum. Of the once popular "single-wheelers," G.W.R. and G.N.R. "8-footers" are included; also M.R., Caledonian and L.N.W.R. examples.

Although there may be little external resemblance in the various types of locomotives shown in the illustrations, it is difficult to find a modern locomotive that does not embody in some form the devices originally employed in the early days of the railway. It is interesting to note the author's opinion that "the tendency of modern design is for greater powers, constructional and detail improvements, and in other ways making for progress."

Striking Innovations in Rolling Stock

New L.N.E.R. Tourist Trains



In the photograph above is shown a twin saloon coach articulated unit, as used in the new L.N.E.R. tourist trains. For the illustrations and information contained in this article we are indebted to the courtesy of the L.N.E.R.

THE passenger coach built for the opening of the Stockton and Darlington Railway in 1825 was, externally, little more than a wooden shed on four wheels. Its passengers sat along the sides facing one another, and there was a table between them. By the time the Liverpool and Manchester line was opened in 1830 passenger vehicles had improved a great deal. First-class coaches approximated more or less to the stage coaches that they superseded, adapted for running on a railway. Second-class passengers were carried in what were practically open vehicles, but with a roof to cover them. Third-class passengers, however, had a very rough time, and were carried in open trucks without seats. Gradually improvements were made from time to time, and eventually in 1844 covered carriages with seats became compulsory by an Act of Parliament, even for third-class passengers.

Later, as a result of competition between various lines, steady progress became the rule in the provision of additional comfort and convenience for the railway passenger. The former Midland Railway introduced a number of American Pullman cars during the 70's, and at the same time abolished second-class travel on its system. Actually what happened was that second-class coaches were used as thirds, the old third-class vehicles being withdrawn. These innovations immediately raised the scale of comfort, and other lines had to provide equally good accommodation. This progress in luxury travel has continued ever since, each system in turn striving to go a step better than its neighbour.

The latest expression of this is seen in the new rolling stock recently put into service by the L.N.E.R., expressly for tourist traffic. Apart from the constructional features of the vehicles—which are novel in many ways—they are noteworthy as regards their internal fitting and decoration. In this they break away completely from the traditional "railway" style of furnishing, and follow essentially modern conceptions in their simplicity and elimination of unnecessary detail.

Five trains composed of vehicles of this type have been constructed to the designs of Mr. H. N. Gresley, each consisting of twelve vehicles. Each train is 677 ft. in length and will carry 600 passengers; it is vestibuled throughout, and its total weight empty is 338 tons.

The train formation consists of an open saloon car with brake compartment; next to this brake vehicle comes an articulated unit of two open saloon coaches, then a buffet car. In the centre of the train are two articulated open saloon units. Another buffet car and twin saloon unit follow, and another saloon brake vehicle. The train is thus symmetrically made up and consists of 12 vehicles, but carried on a total of 20 bogies instead of the 24 that would have been necessary had ordinary construction been followed.

The underframes are of steel, and all the bogies are of the L.N.E.R. standard four-wheeled compound bolster type. The bodies of the open saloons with brake compartment, and the buffet cars, are each 61 ft. 6 in. long and 9 ft. wide. The articulated vehicles are of similar width, but are 52 ft. long.

The exterior finish of the train is a distinct departure from the company's usual practice, and results in a very attractive appearance. Instead of the plain varnished teak the body is painted London & North Eastern engine green up to the waist line and cream above, the roof being finished in white.

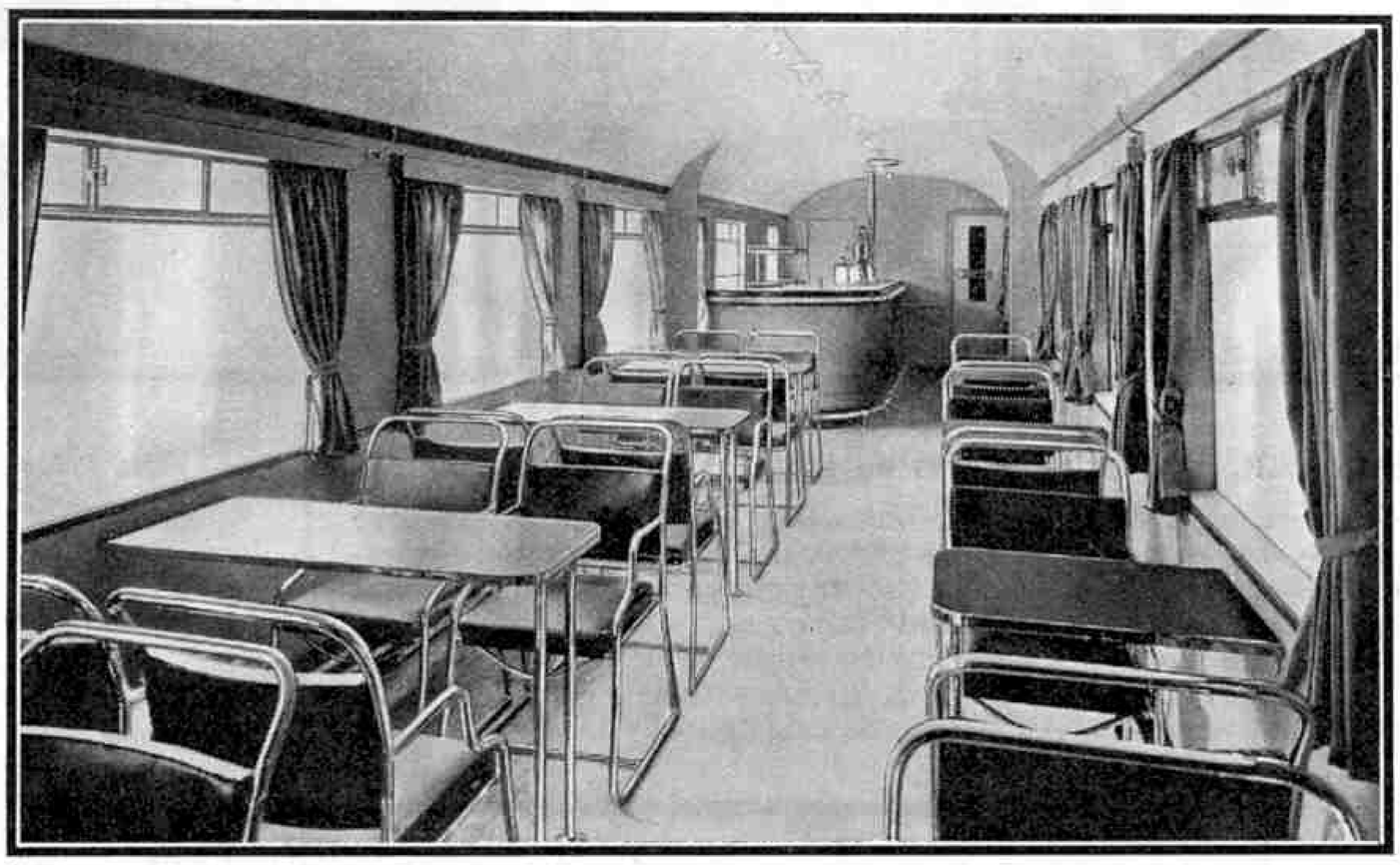
The body construction incorporates several novel features. Wooden framing of teak is employed, but instead of the usual teak panels the whole of the exterior body panelling is of plywood. The teak framework of the body has been designed to eliminate rebating as far as possible, thus reducing machining to a minimum. The body floor boards are bolted direct to the steel underframe, no body cushions being employed. The outer body side panels are of $\frac{1}{4}$" waterproof plywood supplied by Messrs. Saunders-Roe Ltd., of East Cowes, to the very large sizes of 25 ft. long by 6 ft. wide.

The face of all the body framing in contact with the plywood panels is covered with a special Rexine, the panels being bedded in chemical adhesive before being finally screwed into position; the window frames are "Alpax" aluminium alloy die-castings, which are also bedded in chemical adhesive. The resulting structure is exceptionally strong and weather resisting and has proved to be very quiet when running.

As the open saloon accommodation occupies practically

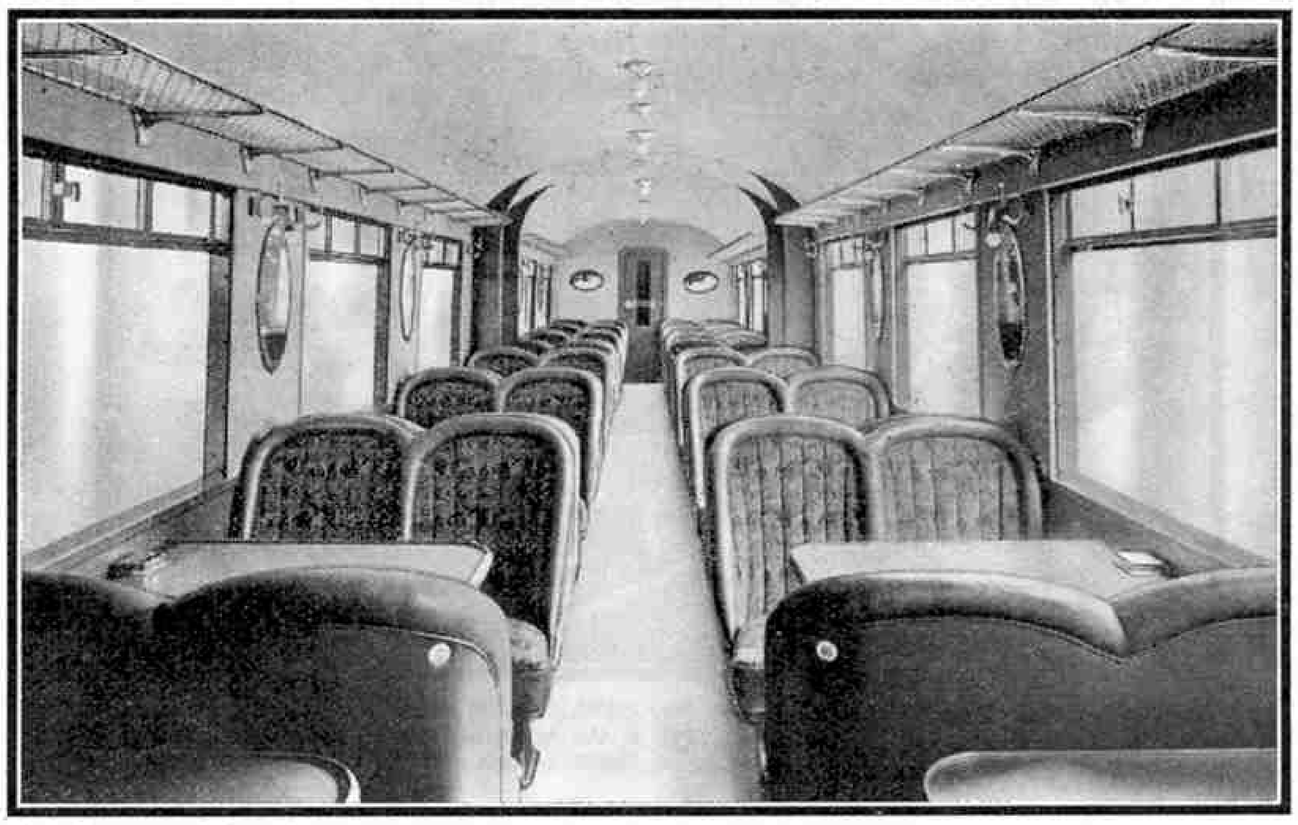
the full length of each coach body it has been necessary to compensate for the absence of cross partitions. For this purpose a steel stiffening rib has been introduced on either side of the centre doorway, the latter being a unique feature. The ribs are screwed to the main pillars, the lower ends being riveted to the underframe and the tops to strong angle hoopsticks.

The interior of the body is lined throughout with plywood, with the exception of the ceilings, which are of special millboard. The partitions are of block plywood, the whole presenting a smooth surface for the application of the Rexine decoration. The interior walls and ceilings are covered with Rexine throughout the train, the colour schemes varying in the different types of vehicles. The saloon floors have a covering of cork lino coloured to match the walls, and the buffet car floor is covered with blue " Korkoid."



An interior view of one of the buffet cars used in the new trains. The reduction of detail in decoration has resulted in a very up-to-date and spacious internal effect.

One of the most interesting innovations is to be found in the seats. The seats in all vehicles, except the buffet cars, are of a greatly-improved semi-bucket type and have been designed to give each passenger a seat to himself with the maximum of room and the greatest comfort. They are upholstered to harmonise with the colour scheme of the saloon, and are arranged in groups of four, two each side of a table. The seat cushions in some of the units have spring fillings provided by the Vi-Spring Company, and in others the fillings are Latex supplied by the Dunlop Company. The introduction of this type of seat will raise the standard of travel comfort considerably, each passenger having an individual seat which is numbered and can be reserved.



A saloon coach interior showing the comfortable character of the accommodation. The vertical steel stiffening ribs mentioned in the article can be seen half-way along the sides of the vehicle.

The buffet car chairs are movable, and are of chromium-plated tubular steel, the seats and backs being upholstered in Rexine. Accommodation is provided in each buffet car for 24 passengers, two seats to each small table at one side of the gangway and four seats to each large table at the other side. The tables are chromium-plated with tubular legs, the tops being covered with black " Korkoid."

A refreshment counter is situated at one end of the car. There is a spacious pantry, which in addition to the large storage cupboards and sinks is equipped with a small grill and gas ring. To ensure that food supplies are kept fresh an electrically-operated refrigerator also is included in the fittings.

The prevailing note in the decoration of the train is modernity in colouring with simplicity of line. The use of mouldings has been reduced to a minimum ; the walls are plain and there is no decoration of any kind on the roof. The resulting effect is entirely successful and has given a sense of spaciousness quite unusual in railway stock built to the limitations of the British loading gauge.

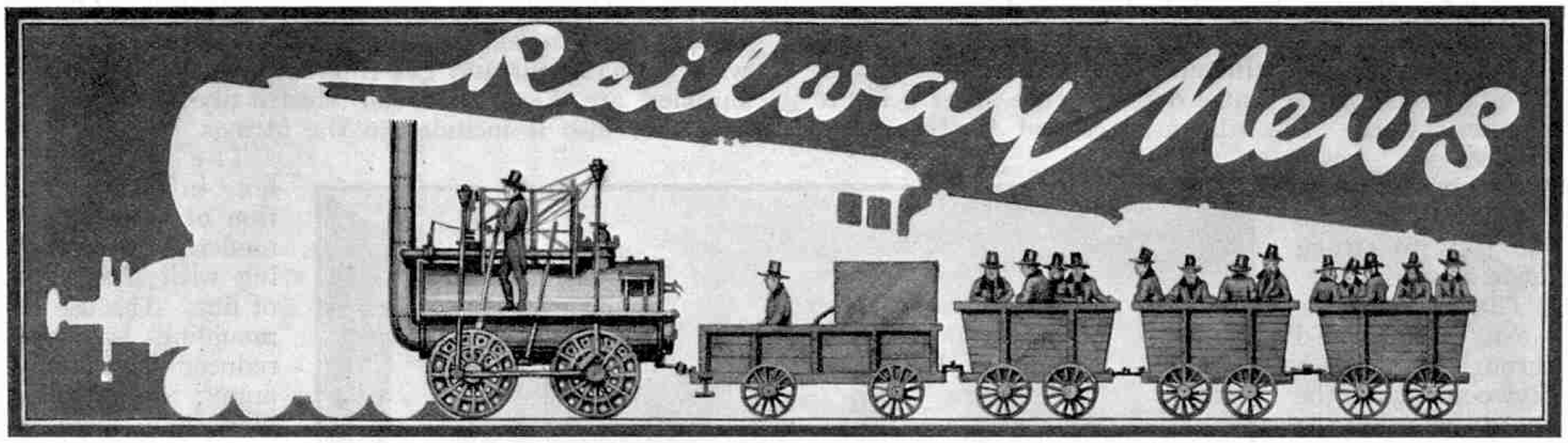
Oval frameless mirrors are fixed on each side and end quarter of the passenger saloons. The luggage racks and similar fitments in the saloons are chromium plated. Metal fitments below the waist line of the body are cellulose finished in a colour to match the decoration scheme, and all roof ventilators and roof lighting fittings are finished to match the roof.

Ample lavatory accommodation is provided on the train, two toilet compartments being situated at the end of each open saloon and so arranged that when the complete train is assembled, four of these are adjacent to each other. Hot and cold water apparatus is fitted to all washbasins.

The train is steam heated throughout, radiators being fitted the full length of the saloons along the body side.

The electric lighting is of the Stone's double battery type, the main saloon lighting being provided by a 40-watt Opal roof lamp in each section with an additional 15-watt lamp over each mirror on the body side. The roof lamps in the buffet cars are 60-watt.

The trains provide a new standard of comfort for the travelling public, and form an important addition to the stock of the London & North Eastern Railway Company. They are being employed for the most part on day excursion duties and have been favourably commented on by all who have ridden in them. One of the first runs made by the first train built was an excursion trip to Blackpool from Boston in Lincolnshire.



Speed Records on the L.M.S.R.

Remarkable speed records were established by the L.M.S. Railway between Euston and Coventry and vice versa on Tuesday, 19th September, when two special trains were run in each direction for the accommodation of guests visiting the Humber-Hillman-Commer motor works at Coventry.

The fastest run of all was made by "Flyer No. 2" returning from Coventry to London in the evening, when the 94 miles from Coventry to a signal stop just outside Euston station were run in the phenomenal time of 74 minutes 20 seconds, at an average speed of 75½ miles an hour start-to-stop.

Including the signal stop of two minutes duration, Euston was reached on this notable run in the unprecedented time of 79 minutes from Coventry. The maximum speed attained was 92 m.p.h. at Castlethorpe, while 90 m.p.h. was touched before Weedon, near Watford, and again at Wembley. The train of seven coaches weighed just over 200 tons and was hauled by the "Royal Scot" class engine No. 6129, "*Comet*," with Driver B. A. Marchant and Fireman W. Aldridge of the Camden (London) depot in charge.

"Flyer No. 1" in the up direction was a heavier train, consisting of 10 vehicles weighing 288 tons and hauled by engine No. 6109, "*Royal Engineer*." It covered the 94 miles from Coventry to Euston in 82 minutes at an average speed of 68.7 m.p.h.

In the down direction "Flyer No. 1" with the same engine and load ran to Coventry in 87¼ minutes at an average speed of over 64 m.p.h.; while "Flyer No. 2" took 86 minutes, including five minutes delays, at an average of 65.6 m.p.h. The schedule times were 90 minutes for the down run and 88 minutes for the up run.

Speedometers on G.W.R. Express Locomotives

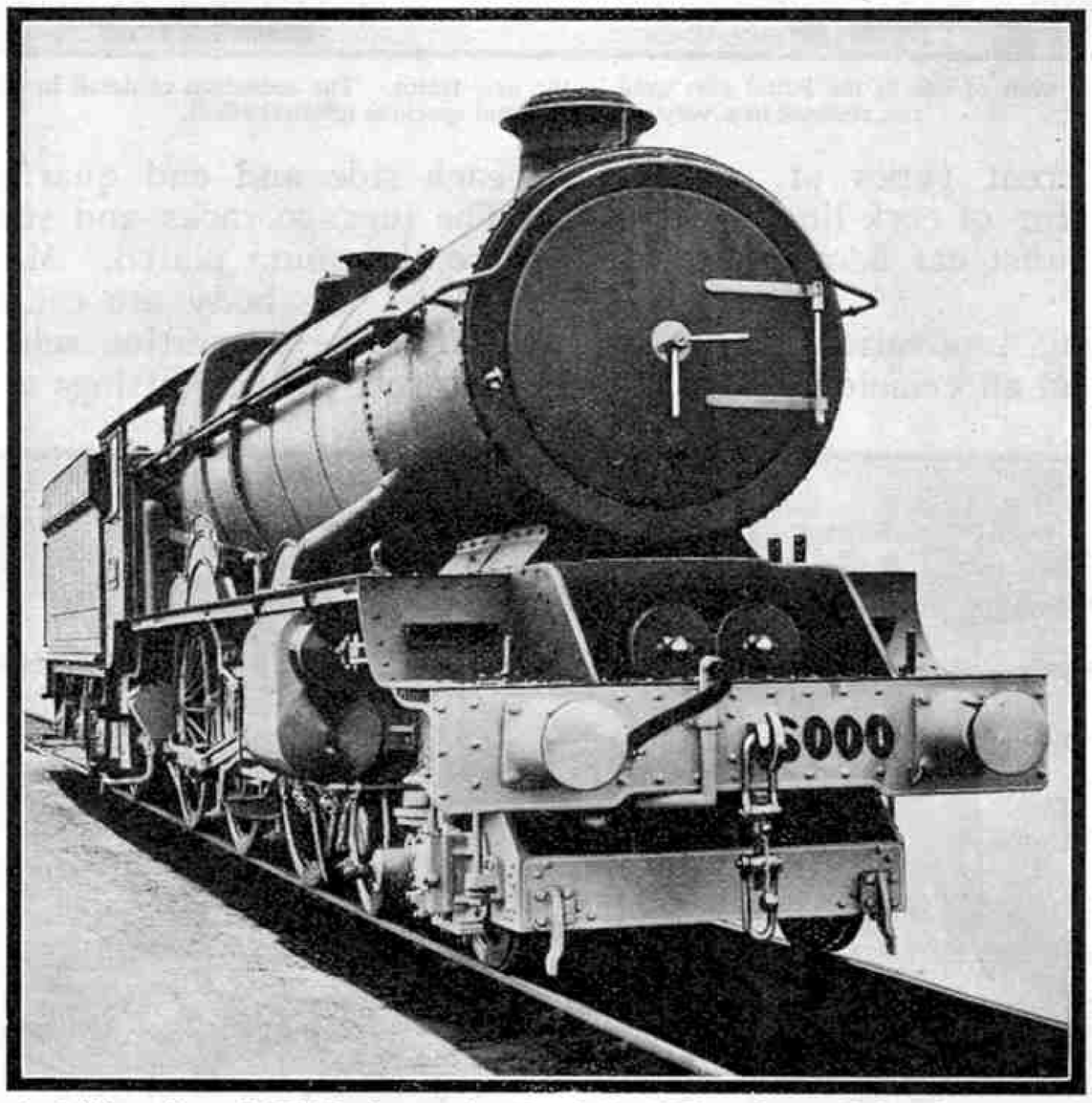
By way of experiment, 12 G.W.R. 4–6–0 express locomotives—six "Kings" and six "Castles"—have been fitted with speedometers. In some countries it is the usual practice to fit express engines with speed recorders, but hitherto only a few have been fitted with them in Great Britain.

Progress on the London "Underground"

In recent weeks some of the progressive schemes undertaken by the London Underground Railways have been completed and new and improved stations have been opened to the public. The old Dover Street and Down Street stations on the Piccadilly tube have been replaced by a very attractive new station named "Green Park." It is very tasteful in design and all its appliances are of the most up-to-date order. High speed escalators, travelling at 150 ft. per min., lead directly from the booking hall on to the end of the platforms.

On the Central London line, the old British Museum station has been closed and a new one—named "Holborn"—has been opened in close proximity to the Holborn station on the Piccadilly line. Its platforms are spacious and its general appearance distinctly pleasing.

Arrangements are being made and will shortly be put into operation for Piccadilly tube trains, which at present do not go beyond South Harrow, to work through to Uxbridge. The total length of this through route across London from Cockfosters to Uxbridge is 32 miles.



A striking view of G.W.R. locomotive No. 6000, "King George V." An unusual feature that is apparent in the photograph is the provision of outside frames for the leading pair of bogie wheels.

The "*Royal Scot*" in America

The tour of the L.M.S.R. "*Royal Scot*" locomotive and train in America has been a triumphal progress throughout. In Canada and the United States alike, the coming of the celebrated train excited the keenest interest. The engine and eight coaches, which left Tilbury on 11th April last, were landed at Montreal and, after being put into running order, started out on tour on 1st May. The route followed included many important cities, among them Ottawa, Toronto, Buffalo, Utica, New York, Philadelphia, Atlantic City, Baltimore, Washington, Pittsburgh, Cincinnati, and St. Louis, and in all 3,181 miles were traversed before Chicago was reached on 25th May.

Everywhere the coming of the train attracted enthusiastic crowds. At the four cities in Canada and thirty-five in the United States where the locomotive and coaches were open for inspection, great numbers of sightseers came, and in not a few cases difficulty was experienced in controlling the crowds. Altogether in the course of the preliminary tour 531,330 persons passed through the train. From 1st June to the end of September the engine and train were on show at the "Century of Progress" Exhibition at Chicago, and a photograph showing the "*Royal Scot*" at the Exhibition, equipped with searchlight and bell to conform to American practice, was reproduced in the article on page 738 of last month's "*M.M.*"

There the engine and train were certainly among the most popular of all exhibits, and by the close of the Exhibition, nearly 2½ million persons had viewed them.

When the Exhibition ended, instead of returning direct to Montreal for reshipment as was originally intended. "*The Royal Scot*" set out for an extended tour, going over to the Middle and Western States and through Canada, visiting 41 more towns and cities, and bringing up the total distance travelled to almost 12,000 miles. Although no spectacular feats of speed have been attempted in the course of the tour, the performances of No. 6100 "*Royal Scot*" have been uniformly creditable, both to herself and to the men who have had charge of her. The engine and train will return to England on the S.S. "*Beaverdale*"—the ship that took them out—leaving on or about 12th November.

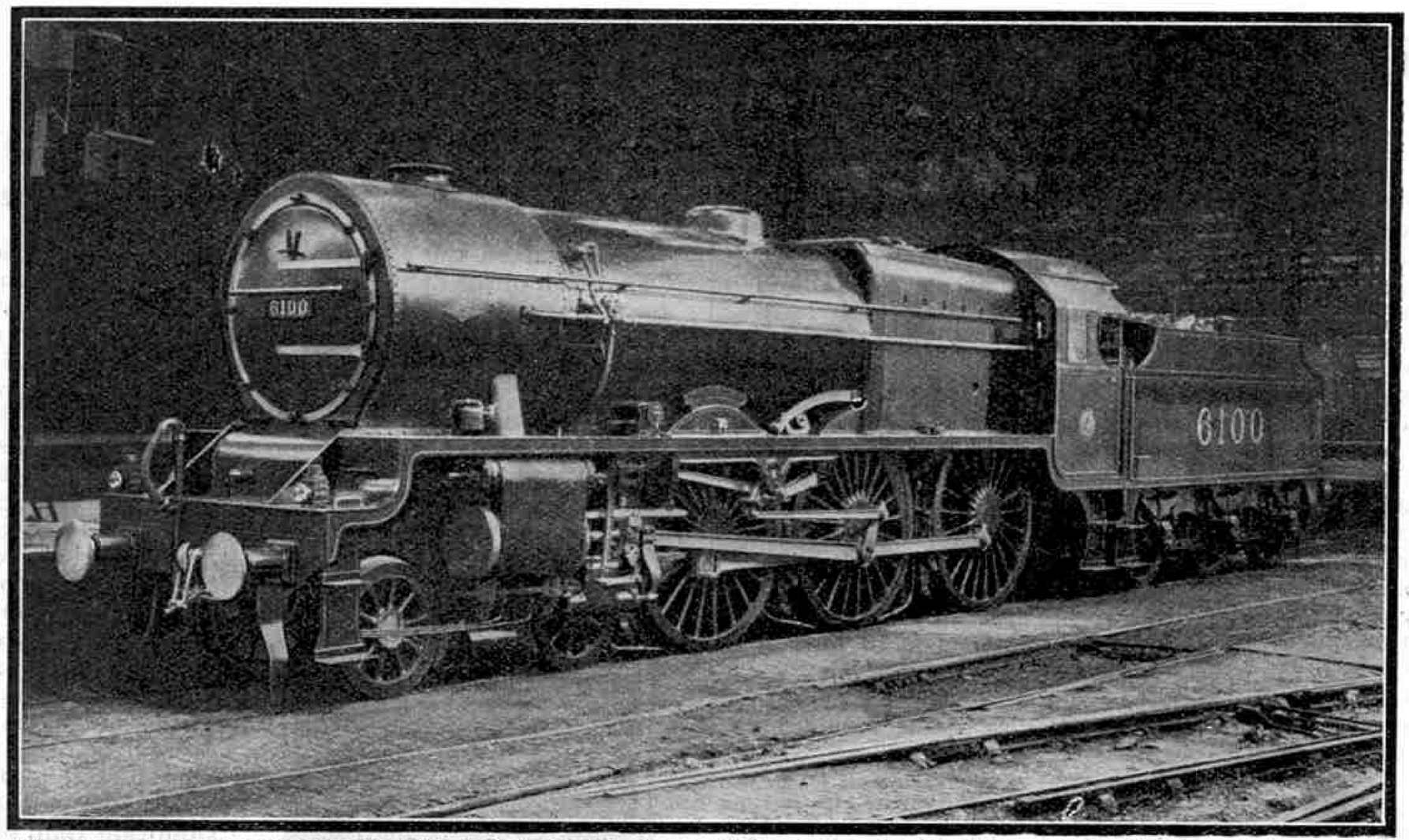
The L.M.S.R. "Pacifics"

The second of the new L.M.S.R. "Pacifics"—No. 6201—left the works at Crewe before the end of September and has since been getting run in prior to entering upon express train duties. When these preliminaries are completed, No. 6201 will share with No. 6200 the daily working of "*The Royal Scot*" between London and Glasgow in both directions. Engine No. 6200, "*The Princess Royal*," first worked "*The Royal Scot*" through from Euston to Glasgow—a distance of 401½ miles—on Friday, 22nd September. The train when it left Euston consisted of 15 vehicles, weighing 431 tons without passengers and luggage, or about 455 tons full. From Crewe onwards the load was reduced by one coach. Schedule time was kept with ease and the formidable banks at Camden, Shap, and Beattock were tackled unassisted, the minimum speed at Shap being 25 m.p.h. and at Beattock 26 m.p.h. On the Crewe-Carlisle section, without calling upon the engine to exert anything like its maximum power, four minutes were saved. A maximum speed of 76.5 m.p.h. was attained thrice in the course of the run and Glasgow was reached over a minute early. On the following day, No. 6200 brought the up "*Royal Scot*" through from Glasgow to London and made excellent running throughout.

Work has gone forward at Crewe on the new lot of 2–6–0 "Mogul" mixed-traffic locomotives. The first 10 will be numbered 13245 to 13254, and several are already in service.

During recent months the Derby works have been engaged on further 2–6–4 standard tank engines, and Nos. 2385 to 2396 have been sent into traffic. Almost all the steam-drawn local passenger services between London (Euston and Broad Street) and Watford and Tring are now worked by engines of this class, which perform their duties admirably. They start smartly, run easily, and are capable of quite high speeds. Their coal consumption is distinctly moderate.

As noted in our article on "*The Search for Locomotive Economy*" on page 858 of this issue, one of the 4–6–0 express locomotives of the former L. and Y. type was converted at Horwich in 1926 into a four-cylinder compound, having outside high-pressure cylinders and inside low-pressure cylinders. This engine—No. 10456—is stationed at Carlisle and has proved itself thoroughly efficient in working the expresses to and from Crewe.



The famous L.M.S.R. locomotive No. 6100, "Royal Scot." As recorded in these pages, its visit with an L.M.S.R. train to Canada and the United States, and its appearance at the "Century of Progress" Exhibition at Chicago, have aroused great interest.

The L.N.E.R. "Flying Scotsman" express on its summer non-stop run from King's Cross to Edinburgh. The locomotive is the well-known "Pacific" locomotive No. 4474, "Victor Wild," that in 1925 was exchanged for a G.W.R. "Castle" for comparative trials. Photograph by W. J. Barker of Leeds.

Winter Train Services

The present winter train services on the railways of Great Britain show further improvements and accelerations. The "*Cornish Riviera Express*" on the G.W.R. is scheduled to arrive at Plymouth 3 min. earlier than last winter, and for the down run of 173.5 miles between Paddington and Exeter, both this train and the "*Torbay Limited*" are allowed in the working timetables only 169 min., requiring an average of 61.6 m.p.h., start to stop. The public timetables show an allowance of 170 min.

On the L.M.S.R., 502 trains on main line and local services jointly save 21 hr. 16 min. daily. The 6.20 p.m. express from Birmingham to Euston now calls at Watford and is timed to cover the 65 miles from Rugby to Watford in 65 min. The down "*Ulster Express*" has been accelerated and gives earlier arrivals of 18 min. at Heysham and 35 min. at Blackpool.

The principal improvements on the L.N.E.R. are in Sunday services and in the acceleration of the cross-country trains between Newcastle and Carlisle. The S.R. continue to run the "*Atlantic Coast Express*" and "*Bournemouth Limited*" throughout the winter. The "*Bournemouth Belle*" all-Pullman train runs on Sundays only. The wonderful electric services between London and Brighton, providing six trains an hour, are fully maintained.

S.R. Locomotive News

Of the newest engines of the "Schools" class, No. 916, "*Whitgift*," No. 917, "*Ardingly*," and No. 918, "*Hurstpierpoint*," are stationed at "Bo-Peep" shed, St. Leonards, while No. 919, "*Harrow*," is at Ramsgate. Additional engines of this class are on order at Eastleigh, but no more will be completed for service this year.

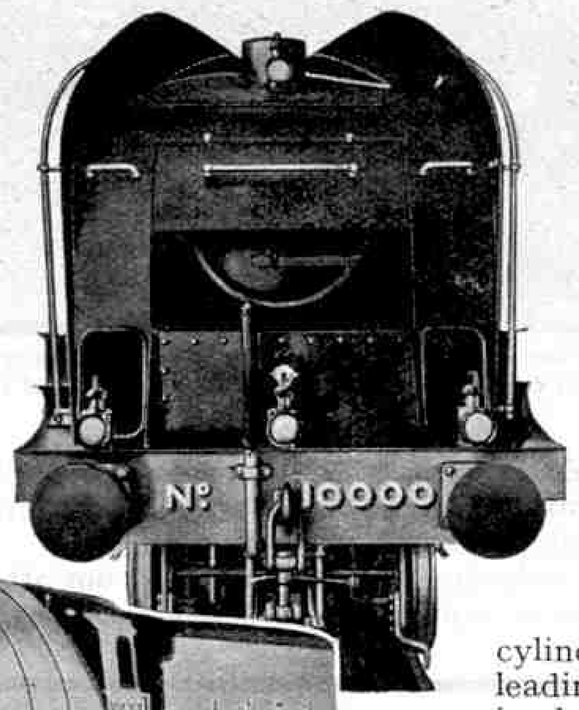
The Search for Locomotive Economy

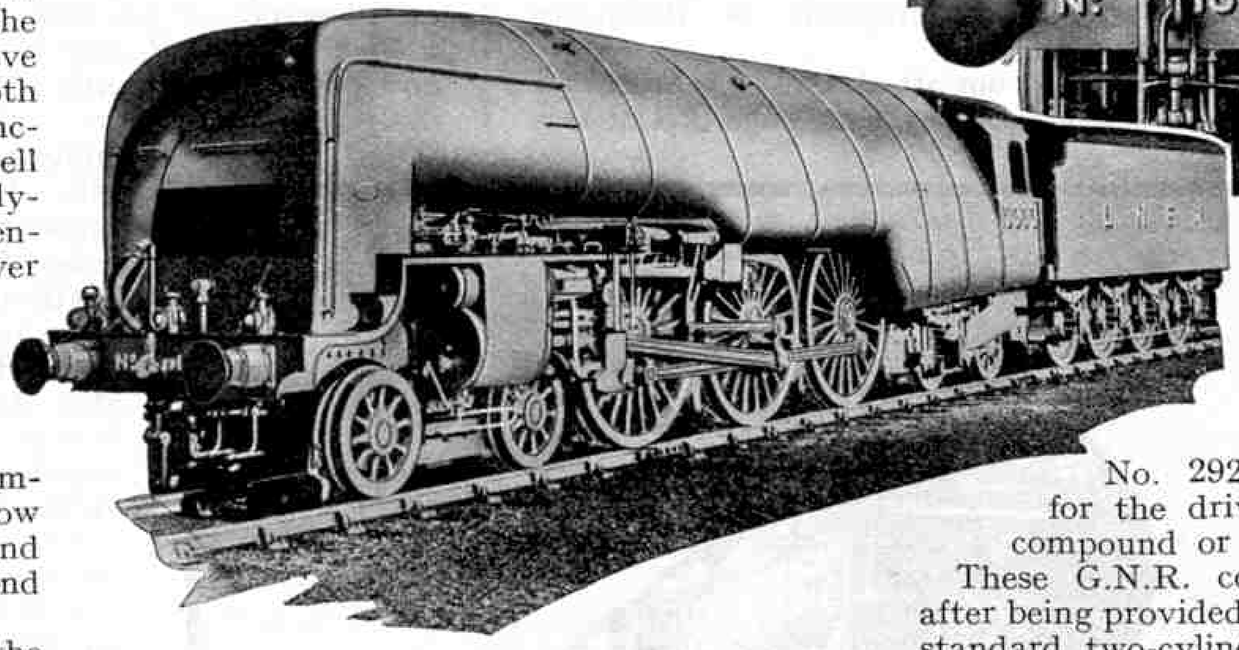
IV.—Compound Experiments and Developments

IN the last instalment in this series of articles we saw how the Worsdell two-cylinder system was followed by the development of the Smith three-cylinder arrangement on the North Eastern Railway, and how this latter plan was followed up on the Midland line. Then came the experimental importation of French locomotives by the G.W.R. The working of these De Glehn engines, and the successful operation of the Smith compounds and their "Deeley" developments on the Midland, caused considerable attention to be directed to compound working about 25 years ago, and resulted in a very interesting chapter of British locomotive history. There was not an outbreak of compound building, however, such as occurred in the eighties of last century when Webb and Worsdell were striving to perfect their systems.

About the same time as the Deeley compounds first appeared, Mr. J. G. Robinson, Locomotive Superintendent of the Great Central Railway, decided to try the Smith system proper in his famous "Atlantic" engines. He therefore applied it to four of them, one in 1905 and the others in 1906. It is interesting that arrangements were made so that the conversion of the simple type of "Atlantic" to the compound, or vice versa, would be possible with the minimum of trouble and expense, if either type should prove the more satisfactory. Actually neither conversion has occurred in the years that have followed, but both types have functioned very well on the steeply-graded Great Central main line, over which the booked timings have always been particularly smart. These compounds are now numbered 5258 and 5259; 5364 and 5365.

Two striking views of the largest compound locomotive in Great Britain, the L.N.E.R. four-cylinder high-pressure "No. 10000." The upper illustration shows its forbidding appearance at the front end, and the lower one the peculiar contour of the engine as a whole. The boiler covering is extended to form smoke deflectors. Photographs courtesy L.N.E.R.





For 20 years the distinction of being the largest compounds in service on a British railway was held by two "Atlantics," Nos. 730 and 731, of the North Eastern. These appeared in 1906, and incorporated the Smith system as applied to four cylinders. The high-pressure cylinders were placed outside, and the low-pressure cylinders inside, all four being connected to the leading driving axle. The four valves on each engine were worked by two sets of valve gear, modifications of Stephenson and Walschaerts motions being provided respectively on No. 730 and No. 731. The fairly high pressure of 225 lb. per sq. in. was used at first, and the boilers were exceptional in North Eastern practice in having fire-boxes of the Belpaire kind. Since the engines were provided with superheaters in 1915, the reduced pressure of 200 lb. has been employed. They have done good work in their time, but in subsequent N.E. practice the simple engine reigned supreme, although the well-known 2–2–4 inspection tank "*Aerolite*" is still running as a two-cylinder compound on the Worsdell system.

The Southern partner of the North Eastern in the East Coast route—the G.N.R.—also took an interest in compounding. Numerous experiments were made by Mr. H. A. Ivatt with the object of producing the best possible design of engine for the prevailing conditions of the G.N.R. line. In No. 292, a four-cylinder compound variant of his famous large-boilered "Atlantic" design, the high-pressure cylinders were only 13 in. in diameter, and with the limited stroke of 20 in. At the same time, 1905, there was built for the G.N.R. an engine of the four-cylinder balanced compound type by the Vulcan Foundry Co. Ltd., of Newton-le-Willows, and an illustration of this interesting engine appears on the next page.

It resembled the French De Glehn engines in the number and disposition of the cylinders, and in the use of independent reversing gears for the high-pressure and low-pressure units. Unlike the Doncaster engines, it had a long narrow fire-box and internally ribbed "Serve" tubes as used in the G.W.R. De Glehn compounds. Although primarily a compound, No. 1300 had a patent starting valve that admitted boiler steam to the receiver, but as soon as this steam entered the low-pressure cylinders when the engine began to move, this valve closed. The valves of both high-pressure and low-pressure cylinders were operated by Walschaerts motion and a patent reversing arrangement enabled them to be operated, independently or in conjunction, by a single reversing screw. The two reversing rods may be seen in the photograph of this engine on the next page.

In 1906 comparative trials with similar trains at similar speeds on the G.N.R. main line showed that No. 292 was more economical in coal consumption than either No. 1300 or No. 294 of the normal simple design that were tried against it.

In the following year another compound engine, No. 1421, similar to No. 292, was built at Doncaster. This was also an "Atlantic," and had four cylinders with divided drive. The leading coupled axle was interesting in being of the built-up balanced pattern that was the subject of a patent by Mr. Ivatt. It was built up in two main parts bolted together, with a wide tongue joint interposed to relieve the bolts of any twisting stresses. The wide type of fire-box reappeared in this engine, and as in No. 292, a special change valve made it possible for the driver to operate the engine continuously as a compound or as a simple locomotive.

These G.N.R. compounds were not developed further, and after being provided with a superheater in 1914, No. 1421 became a standard two-cylinder superheated simple "Atlantic" in 1920. In 1917 the Vulcan Foundry engine, No. 1300, was also converted to simple propulsion with two cylinders, the drive then being taken from outside cylinders to the leading driving wheels. Outside Walschaerts gear was employed, the piston valves being above the cylinders; and the latter were set above the bogie wheels in the normal position. The original boiler and fire-box were retained—in itself a proof of the quality of workmanship put into the engine—but a superheater and ordinary tubes displaced the original Serve tubes. This interesting engine has since been withdrawn from service, and No. 292, the Doncaster compound, also is no longer running.

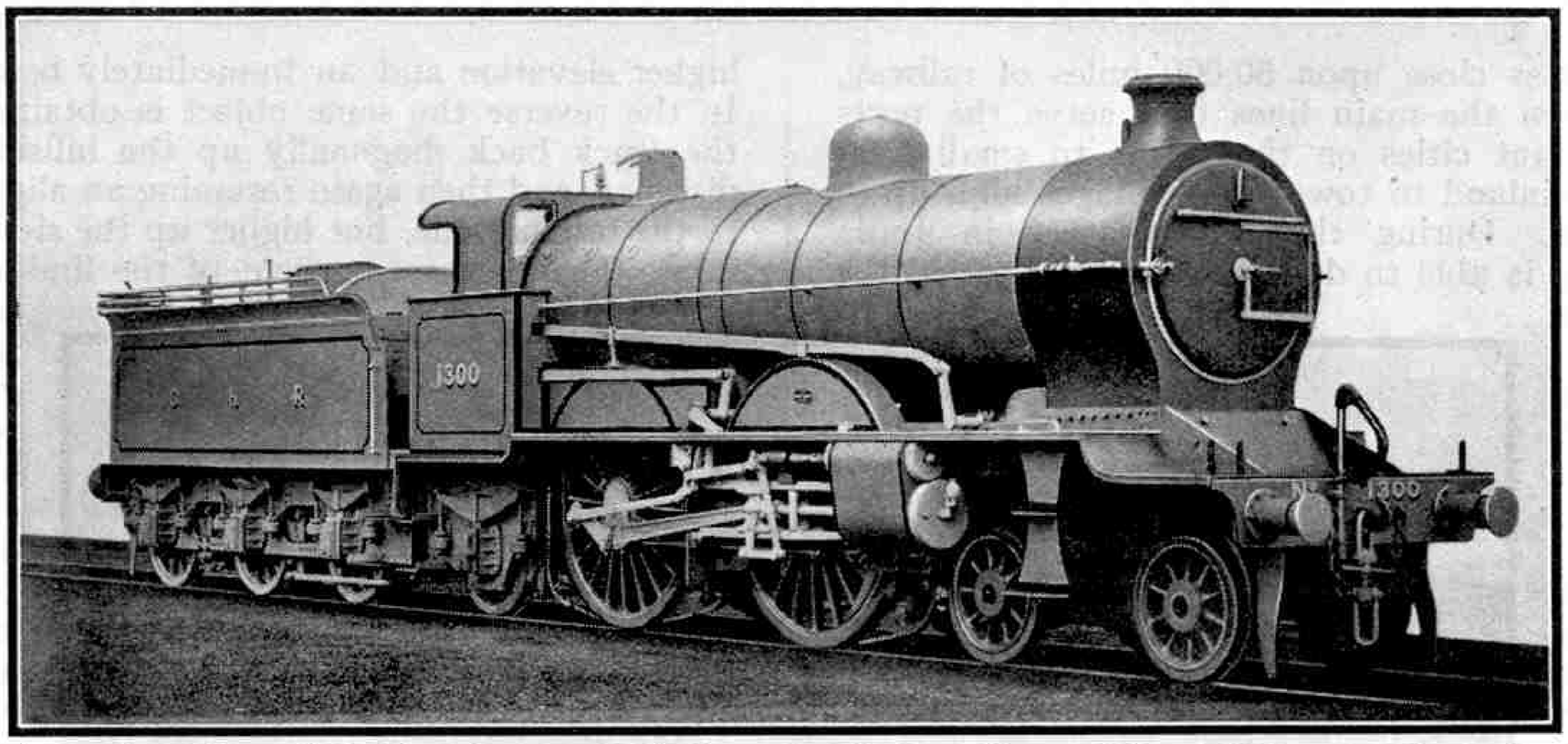
In the years immediately prior to the War the application and development of superheating apparatus, as described in the "*M.M.*" for May, 1932, was another phase of the search for locomotive economy. In this country it undoubtedly diverted the attention of locomotive engineers from the subject of compounding, so that little further interest was given to this after the construction of the locomotives we have described. The Midland compounds continued to run successfully, though none had been built more recently than 1909. These were Nos. 1000–1044, and they still bear these same numbers. In 1907, when the Midland locomotive stock was renumbered, the Smith compounds originally Nos. 2631–2635 became Nos. 1000–1004, and the first "Deeley" engines of 1905–06, originally Nos. 1000–1029, became Nos. 1005–1034. The engines of 1908–09 were not affected by the renumbering and have always been Nos. 1035–1044.

Soon after the formation of the L.M.S.R. group further examples

of the Midland compounds as superheated were put in hand, but with driving wheels slightly smaller and cylinders slightly larger. While in the later engines of the series the reduced wheel diameter has remained unchanged at 6 ft. 9 in., the original cylinder dimensions have been reverted to.

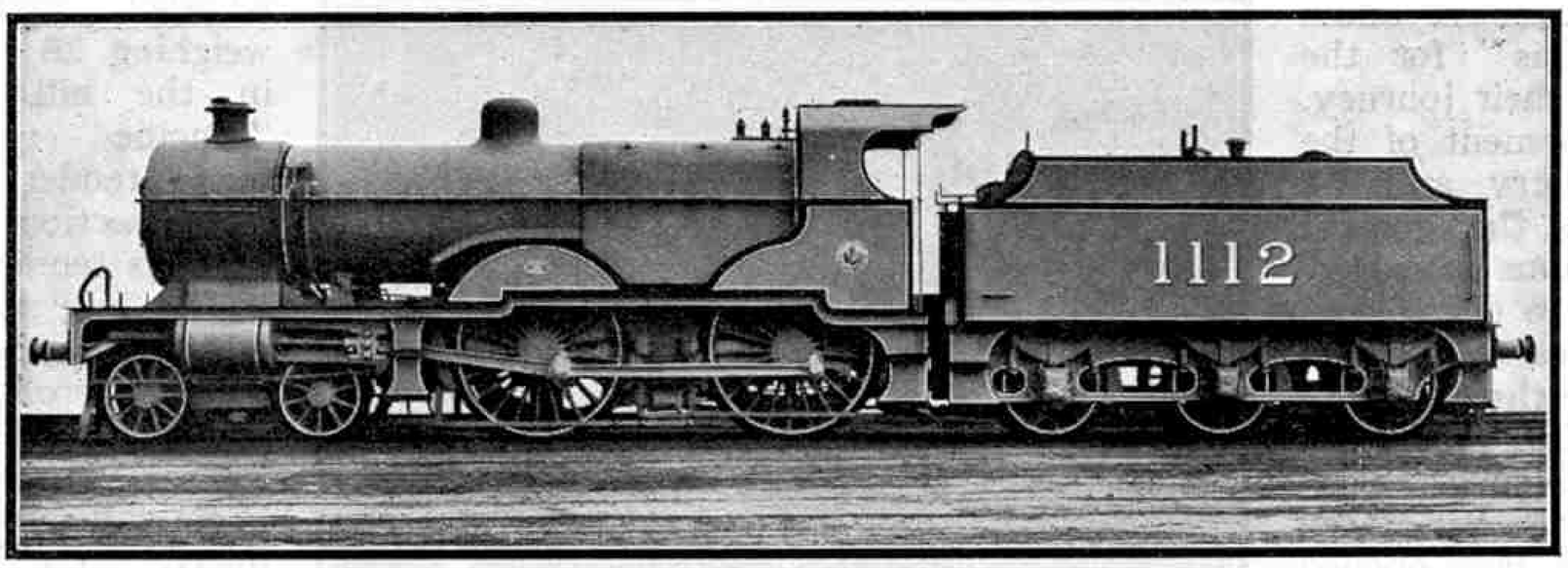
Further multiplication of the design followed for use on sections of the L.M.S.R. other than the Midland. To make them suitable for running within the restrictions of the Scottish loading gauge, No. 1065 and the engines subsequently built were provided with chimneys and domes of reduced height, while Ross "pop" safety valves also made their appearance in these later engines.

It was apparently thought desirable that the engines for the Western, Central and Scottish Divisions should continue the practice of those lines in being driven from the left-hand side, so that the more recent engines have been built with the reversing gear and regulator arranged to be handled from that side. Of course, some of the left-hand drive engines might be found on the Midland section and some of the opposite kind elsewhere, but recently there has been a tendency to concentrate those with right-hand drive on the Midland, where such practice has been standard for many years.



An experimental four-cylinder balanced compound of the former Great Northern Railway. This was built for comparative running with Doncaster engines in 1905 by The Vulcan Foundry Ltd. of Newton-le-Willows, to whom we are indebted for the photograph.

The introduction of such "foreigners" to the Western Division in particular was the cause of much comment at first, but as the men became more used to handling them these "Crimson Ramblers" achieved a reputation for fast travelling and generally satisfactory performance, provided they were not overloaded. When worked as intended, on fast trains of weights suited to their capacity, they quickly showed their quality, and thus the speedy Birmingham and Wolverhampton expresses from Euston, except for the hardest trips, are almost exclusively taken by compounds.



The latest development of the Midland compound design. The photograph shows the appearance of the standard L.M.S.R. engines of this class with boiler mountings of reduced height. Photograph courtesy L.M.S.R.

In Scotland, after some unfavourable first impressions, they have come to be recognised as "graund goers." Indeed much of the work demanded of them by the Scottish authorities is far in excess of that required on the parent system. The Scottish drivers appear to be able to extract the very best from the engines, for some of the turns operated by compounds on both Caledonian and G. & S.W.R. sections are extremely hard. The L.M.S.R. compounds are Nos. 1000 to 1199, and there are also Nos. 900 to 939, the last five of the latter having been turned out in 1932 under Mr. Stanier's supervision.

This three-cylinder compound system was introduced to Ireland last year by the building for the G.N.R. of five large 4–4–0 locomotives, described in the August, 1932, "*M.M.*" In these the Deeley arrangement of regulator is used, by permission of the L.M.S.R. authorities. The cylinders of these locomotives are reduced in diameter from the Derby dimensions, but the boiler pressure is increased to 250 lb. per sq. in. The capable nature of these engines is reflected in the smartly-timed services between Dublin and Belfast for which they were specially built.

The successful and economical work of the L.M.S.R. compounds had another interesting result some years ago, which gave that company the distinction of owning the largest and most powerful British compound, the two N.E. four-cylinder "Atlantics" being thus outclassed. One of the well-known Horwich four-cylinder 4–6–0s was converted to a compound in 1926, when various experiments were being made on the L.M.S.R. before the introduction of the "Royal Scots." The method of operation of this engine is interesting. At starting in full gear, boiler steam passes direct to the low-pressure cylinders. Then, when the driver notches up and brings the cut-off below 70 per cent., a control valve worked off the reversing motion causes steam to pass to the high-pressure cylinders and compound working commences. The high-pressure cylinders are outside and have a diameter of 16 in. The low-pressure cylinders are very nearly the largest that have ever been fitted between the frames of a British locomotive, being no less than 22 in. in diameter. The G.N.R. engine No. 1300 had inside cylinders 23 in. in diameter in its compound state. The stroke is 26 in. for both high-pressure and low-pressure units. The conversion has resulted in a notable economy in fuel consumption as compared with the simple engines of the same class.

This locomotive was in turn ousted from its position as the largest British compound, when in 1929 the L.N.E.R. locomotive "No. 10000" appeared. Thus, although Mr. Gresley was responsible for the conversion of the G.N.R. compounds to simple engines, he has reverted to the compound principle in what is perhaps the most remarkable British steam locomotive yet built. By reason of its striking external form it has attracted a great deal of public attention, and it is one of the few definitely experimental engines that have successfully taken regular turns in traffic working in link with other engines. The most notable features of its design have previously been referred to in the "*M.M.*," and no doubt many of our readers have taken the opportunity of inspecting it when it has been exhibited at different places.

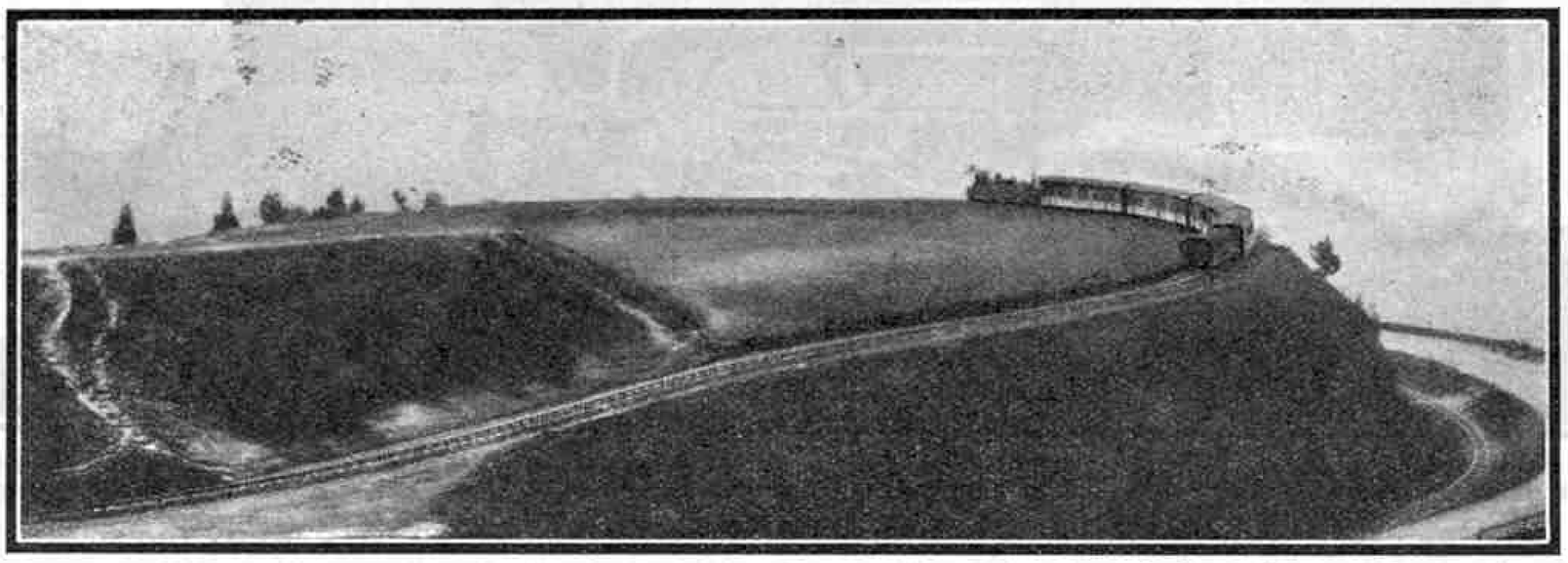
The adoption of a working pressure of 450 lb. per sq. in. necessitated the employment of a special Yarrow water-tube boiler, and the steam generated passes first to the outside cylinders and from these to the inside cylinders. Although a four-cylinder engine, it has only two sets of Walschaerts motion, operating directly on the outside high-pressure valve spindles. The low-pressure valves are driven by means of a special connection incorporating an ingenious arrangement patented by Mr. Gresley, which enables separate points of cut off to be reached in the high-pressure and low-pressure cylinders, and is a notable achievement in design.

At present there is a general tendency to improve the simple locomotive rather than to adopt the compound. On the L.M.S.R. the simple "Royal Scots" give efficiency figures superior to the Midland compounds; and even in France, long the recognised home of compounds, simple locomotives of advanced design are appearing.

An Interesting Indian Mountain Line

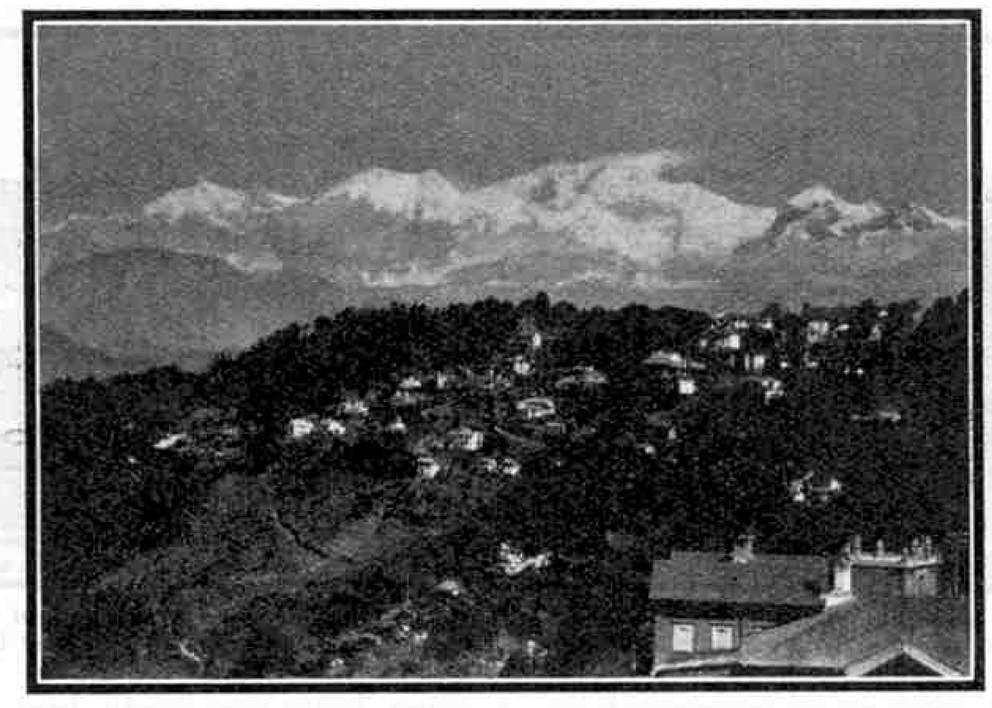
The Darjeeling-Himalayan Railway

INDIA possesses close upon 50,000 miles of railway, ranging from the main lines that serve the ports and important cities on the plains to small lines that penetrate inland to towns and villages high up in the Himalayas. During the hot weather in India everybody who is able to do so leaves the heat of the plains for the cool of the hills, and traffic on these small railways is then very heavy. The Darjeeling-Himalayan Railway, the subject of this article, has an important share of this traffic, but the line is used chiefly in connection with the many tea plantations along its route.



The Batasia Loop on the Darjeeling-Himalayan Railway. This loop is the last of a series by which the railway obtains an easy ascent over the steepest sections of the route.

The Darjeeling-Himalayan Railway is of 2 ft. gauge and runs from Siliguri on the plains to Darjeeling in the Himalayas. Siliguri is also the terminus of the Eastern Bengal Railway main line from Calcutta, which was opened for traffic in 1878. At that time travellers to Darjeeling obtained at Siliguri native conveyances known as "tongas" for the uphill portion of their journey. The rapid development of the tea-growing industry, and the inconvenience to the general public in the tedious ascent by tongas, soon led to dissatisfaction with this means of transport, and in 1879 the construction of a steam railway along the cart road from Siliguri to Darjeeling was begun. By March 1880 the line had been opened to Tindharia, and Lord Lytton, the first Viceroy to visit Darjeeling, was conveyed to that point. The line was completed and opened for traffic through to Darjeeling in July 1881, and the company was then named the Darjeeling-Himalayan Railway Company.



A fine view of the snow-capped peaks of the Himalayan Mountains, as seen from Darjeeling.

The alignment of the railway followed that of the road throughout, but it soon became apparent that some of the grades were much steeper than the locomotives could manage without great waste of power. Deviations were made, therefore, loops and reverses being constructed to obtain an easier ascent and to enable heavier loads to be drawn up the mountain. In the case of the loops the line circles round and passes over itself by a bridge, thereby quickly attaining a higher elevation and an immediately better alignment. In the reverse the same object is obtained by running the track back diagonally up the hillside for a short distance, and then again resuming an alignment parallel to the original one, but higher up the side of the mountain. The average gradient of the line is 1 in 25, but in parts of the hill section the gradient is in places as steep as 1 in 20.

The engine originally employed was small even for a 2 ft. track, and was only capable of drawing a load of about seven tons. It has now been superseded by a standard type engine capable of drawing a load of 35 tons up the improved track, and the speed attained on the upward journey is now 12 m.p.h. as compared with 7 m.p.h. formerly. The standard engines now employed have four-coupled wheels, cylinders of 11 in. bore and 14 in. stroke, and weigh 14 tons. A "Garratt" eight-wheeled articulated engine weighing 28 tons is also used in the hill section, and a "Pacific" type engine with bogie tender is used in the plains section. The "Pacific" with its tender weighs 39 tons.

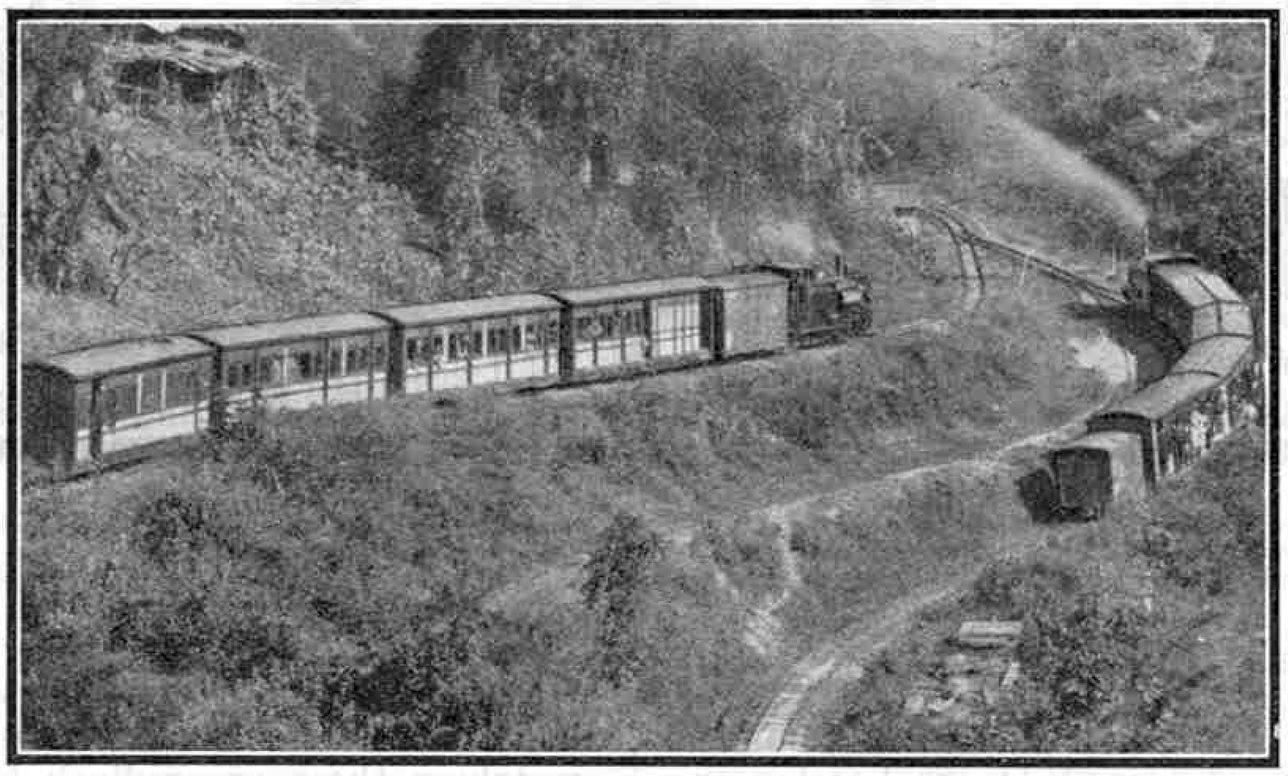
The first passenger vehicles on this railway were small four-wheeled trolleys with canvas roof and two wooden benches for seats, but some years later bogie railway stock was introduced. Carriages 26 ft. 6 in. long and comfortably equipped are now in regular use. Bogie vans and trucks are also used, and the longest bogie truck is 32 ft. New workshops were opened in 1914 at Tindharia, and all rolling stock except wheels is now built there.

The upward freight traffic of the hill section of the line is principally rice, flour, tea garden stores, oil, coal and general stores; the downward traffic is chiefly tea, seed, potatoes and fresh vegetables.

A traveller approaching Darjeeling from Calcutta transfers at Siliguri station from the Eastern Bengal line to the little mail train of the mountain railway that stands waiting on the narrow gauge track. Shortly after leaving Siliguri, 500 ft. above sea level, the train crosses the Mahanaddi Bridge, 700 ft. long, and traverses

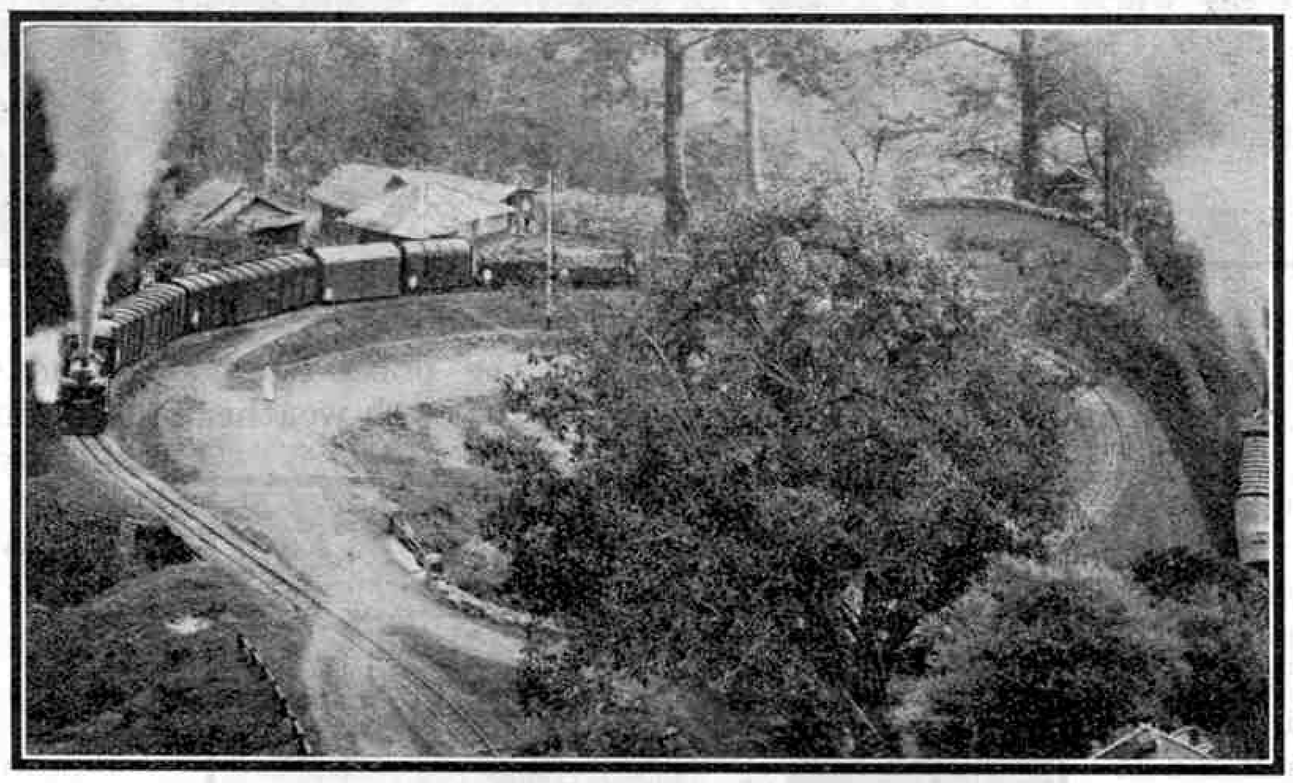
comparatively level country until Sukna station, six miles distant, is reached. Here a short halt is made for the engine to take water, for from Sukna the ascent of the mountain begins in earnest. The route lies up a spur of the Singalela range, the range of mountains that terminates in Kanchenjunga, 28,146 ft. high, which is itself the centre of a group of the highest mountains in the world.

Beyond Sukna the scenery changes, and the train begins to climb through the extensive lower forest that provides cover for tigers, leopards and wild buffalo. On one occasion a herd of wild elephants disputed the passage of the train through this forest, and the driver was compelled to put back into Sukna and await the departure of the unwelcome marauders! Varied tropical creepers hang in great profusion from the trees, and giant bamboos wave their feathery crests above.



This photograph gives an excellent idea of the locomotives and coaches used on the line.

The line now winds in and out of the ravines of the mountain sides with many and swiftly following curves. The rst halt is made at a water stop a short distance beyond Rangtong station, 1,400 ft. up. Resuming the journey the train climbs steadily, and soon the traveller has a fine view of the lower hills. A little below the 2,000 ft. altitude post the train runs round the Chunbhati Loop—a double circle—and after another few minutes it passes out of the forest and round the end of a spur. The view is now completely changed and the traveller finds himself right among the mountains. The train zig-zags up Selim Hill, passing to and fro along the slopes of this mountain no less than five times, and shortly after the fifth reverse reaches Tindharia station, 2,822 ft. above sea level.



A freight train negotiating one of the loops. The glimpse of the line at a lower level on the right of the photograph indicates the steep gradient of the loop.

At Tindharia there is a short halt for morning tea and coffee, and the traveller also has an opportunity of enjoying the wonderful panorama of rugged mountains and intervening hills and valleys. Beyond this station the train negotiates another reverse, and later a loop, the curve of which had to be cut very sharp—59 ft. radius—owing to the contour of the hillside, and entailed a great deal of work. The line now runs along the eastern side of a great mountain that has been largely cleared for tea cultivation, but there are numerous wooded ravines to be seen. Gayabari station is passed at 3,400 ft., and at 4,864 ft. Kurseong, a thriving hill station, is reached, and a halt is made for breakfast.

Immediately after leaving Kurseong the traveller obtains a fine view down into the valley of the River Balasum, and the line traverses the eastern slope of this valley for 16 miles. The snow-capped mountains to the north, and the white peaks of Kanchenjunga and its neighbours, now come into view through a gap in the nearer hills. At Tung, 5,656 ft. high, the engine again takes water; Sonada is passed at 6,552 ft., and shortly afterwards the 7,000 ft. altitude post is reached. From here to Ghum, 7,407 ft. up and the highest point reached by the railway, the line skirts a Government Forest Reserve, and soon the train enters and passes through the Ghum Bazaar under the shadow of the lofty Senchal Mountain. Ghum station is on the road to Tibet, and is the first outpost of that country. It is 40 miles from Sukna, and in covering that distance the little train climbs 6,907 ft. From Ghum the line descends for four miles down a wooded spur to Darjeeling station, 6,812 ft., traversing en route the Batasia Loop, the last of the loops. The magnificent panorama of mountain scenery that lies open to view at Darjeeling is one of the great sights of the world. The twin peaks of Kanchenjunga, 45 miles distant, tower above a majestic line of snowy summits that includes no less than seven other peaks rising above 22,000 ft. and none below 15,000 ft.

An important branch line known as the Teesta Valley Extension of the Darjeeling - Himalayan Railway leaves the main line just outside Siliguri station. This branch line follows very closely an old Government-made road that was abandoned after long portions of it were destroyed during a great flood in the River Teesta, in 1899. As a result of the damage done a new road was built at a higher level during 1907-8. A few years later the Darjeeling-Himalayan Railway Company took over the old road and used it as a basis for a railway track up the Teesta Valley, and this branch was opened for traffic in 1915.

For the first 12 miles from Siliguri the Teesta Valley line crosses a region of forest trees and tea plantations that skirts the base of the Himalayas. The track is here laid beside a broad cart road and is soon fringed by a sal tree forest that provides cover for tigers and elephants. Then the Sevoke River is crossed by a fine bridge, just above its junction with the Teesta; and the Valley of the Teesta itself, at

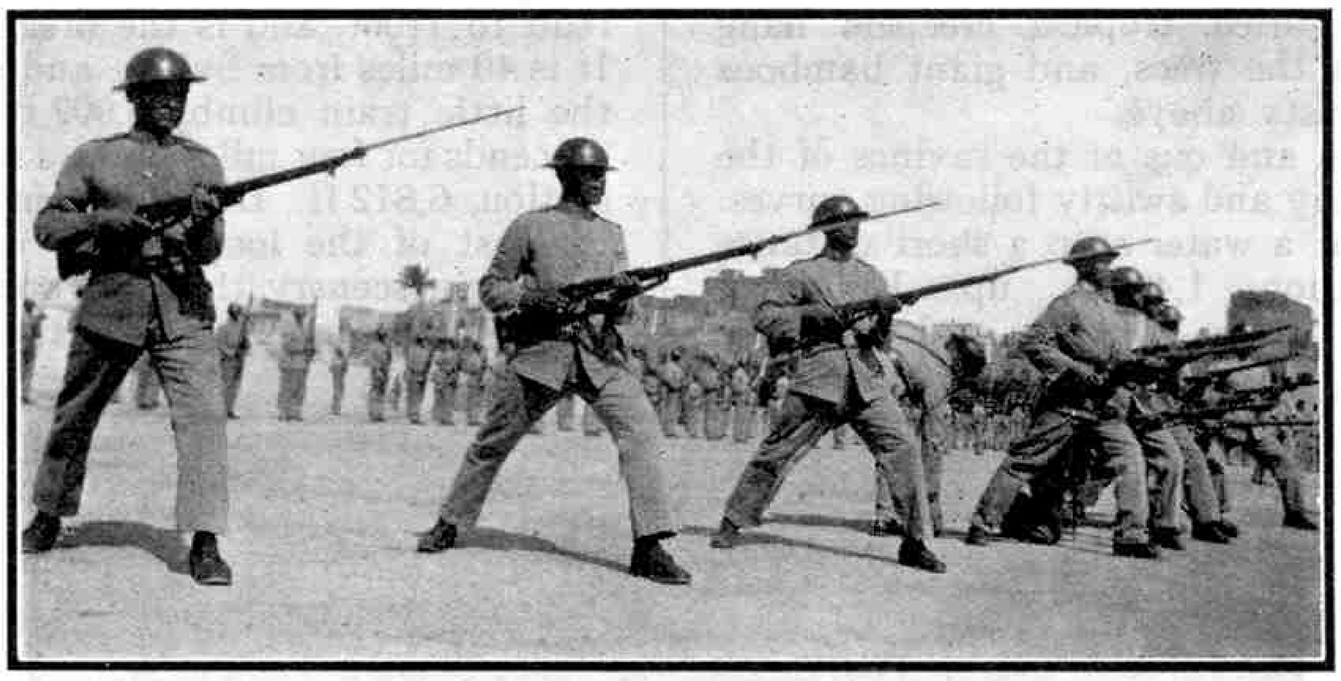
(Continued on page 884)

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Holiday in Egypt

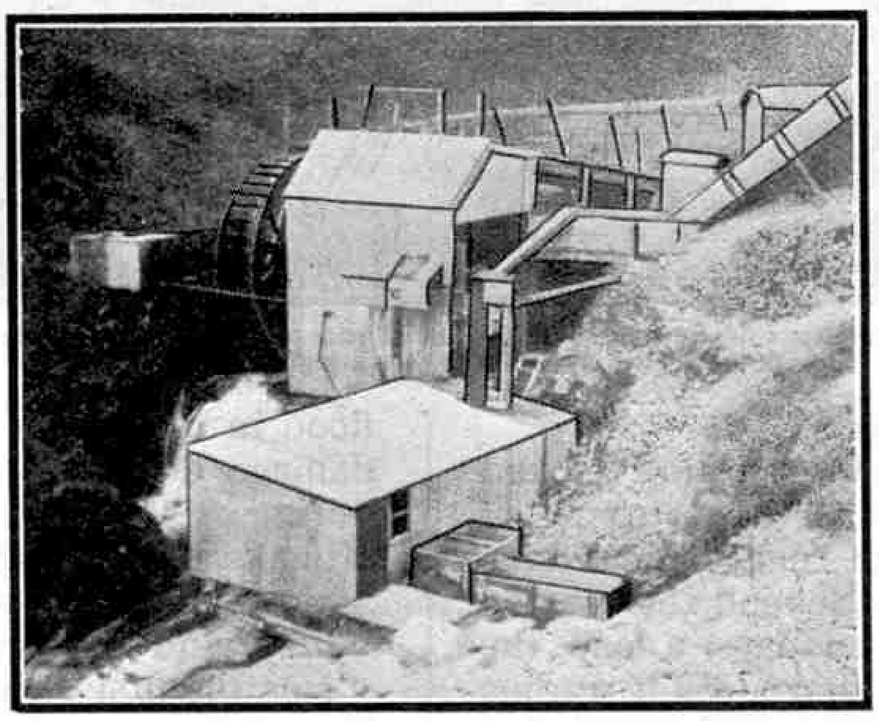
When the time came for me to spend a summer holiday in Egypt, I left King George V Docks, London, in the P. & O. Liner "*Ranchi*," a vessel of 17,000 tons. We called at Southampton, and from there to Gibraltar, our next port of call, the ship was crowded. I spent three hours ashore while the vessel stayed at Gibraltar, and had sufficient time to stroll round the town and to make several purchases.

The "*Ranchi*" went on to Marseilles, where mails were taken on board, and to Malta, where many people left the vessel. Then came the last stage of the voyage to Port Said, and on the day before we arrived there the bridge and the engine room were thrown open to passengers. I greatly enjoyed inspecting these parts of the vessel, and was particularly impressed by the cleanliness of the engine room. My father, who was Commandant of Police in Alexandria, met me at Port Said, and after a tiring train journey of eight hours I reached Sidi Gabes, a suburban station at Alexandria.



Egyptian police in Alexandria at drill. Photograph by W. B. Henn, Elstree.

My holiday was one of the most interesting I have ever had. Nearly every day I bathed in the morning and sailed in the harbour in the afternoon. I often watched the police at drill, always an attractive spectacle, and was fascinated by the special displays arranged by them. The climax of the holiday came when the Mediterranean fleet visited Alexandria. "*Queen Elizabeth*," the flagship of the fleet, led the way, and the Admiral then made an official call on the Governor of Alexandria. Later the Governor returned the call. My father accompanied him to the "*Queen Elizabeth*," and a salute was fired as they left at the close of their visit. I had the privilege of watching these proceedings from a launch.



A Welsh gold mine. A general view of the King Edward mine, Trausfynydd. Photograph by L. Wright, Pengam.

At the end of my holiday, I travelled to Port Said, where I had to spend the night, for the "*Comorin*," the vessel in which I was to return, had been delayed in the Indian Ocean by monsoons. Eventually we left the famous port and I settled down for the voyage. The time passed pleasantly in deck games and sports, such as wrestling on a spar over the swimming bath, and in calls at the ports visited on the way. After experiencing fairly rough weather on entering the Atlantic Ocean I at last reached London—nine days late for school!

W. B. HENN (Elstree).

In a North Wales Gold Mine

Behind the house near Dolgelly where I stayed during a recent visit to North Wales, there was a derelict gold mine. The entrances to the shafts were open, but it was dangerous to enter, for they were full of water. While exploring the neighbourhood we came upon the shafts of other abandoned gold mines, for the district was extensively worked about 70 years ago. Our interest in gold mining was aroused by these discoveries, and we were therefore delighted when given an opportunity of visiting the only gold mine open in that district. This was the King Edward Mine, situated near Trausfynydd.

The mine was reached by a journey on foot along a

stony road high in the mountains. On our arrival we were given candles by the owner, who led us into a tunnel through which ran a narrow gauge railway line. As we made our way along we heard a drumming noise that became more and more distinct. At last we came to a ladder in the wall, and on climbing it we solved the mystery of the origin of this noise, for a few yards along a low tunnel was a miner at work with a pneumatic drill. We were compelled to stoop low in order to approach him. He was drilling a ring of holes into the rock, and told us that dynamite would be put into these in order to enable the mass to be blasted out.

Our guide now showed us where efforts to drive a shaft to a lower level had been prevented by flooding, and then we retraced our steps between the dripping walls until we reached the outer air. There rock brought out of the mine was piled. Some of this seemed to contain veins of gold, but we were told that the glittering yellow substance was only iron pyrites, a mineral that has often deceived the unwary.

The ore is worked on the usual lines, being crushed to powder and washed over copper plates covered with quicksilver. The gold amalgamates with the quicksilver, and every week the amalgam formed is scooped off the plates and heated to drive off the quicksilver, the vapour of which is condensed for further use. The pure gold is left behind in this operation and is melted down into ingots.

Most of the machinery of the mine is driven by a water wheel, but air is compressed for the drills by means of petrol engines.

L. WRIGHT (Pengam).

Belgian and Dutch customs officials at the frontier near Breskens, Holland. The photographs on this page are by E. Marshall, Ealing Common.

Market Day in Middelburg

Whilst staying in Ostend recently I visited Middelburg on the island of Walcheren, in Holland, on market day. The journey was made by motor coach and our way led past the Mole at Zeebrugge. Presently we turned into a narrow cobbled country road that for some distance ran alongside a steam tramway of 4-ft. gauge. There we overtook a train of two coaches, out of the windows of which were leaning girls with picturesque head-dresses. The engine was a squat 0–4–0 tank that was almost as broad as it was long, and its tanks were so low that they touched the grass at the side of the track. The coaches were four-wheel bogie cars, and in appearance reminded me of the cars on pioneer American railroads. This train was slow and we were soon a long way ahead of it.

At the frontier, a Belgian official examined the petrol tank before allowing us to proceed to Breskens, where we left the coach and boarded a small paddle wheel steamer for Flushing, three miles distant. The vessel was crowded and the sea rough, waves sweeping right over the deck, and we were therefore very glad when we again set foot on shore.

The rest of our journey was made by train, and on our departure from the station, I got a glimpse of the coaches used on the trains to Budapest, and of the huge 4–6–2 locomotives, painted green, that haul them. At last we arrived at Middelburg station. There was no platform and we had to clamber down from our coaches as best we could and walk over the tracks in order to reach the station buildings.

We stayed in Middelburg about three hours, and were greatly interested in the market and in the quaint dress of the people who attended it. Then we started on our return journey to Ostend. This time the short voyage between Flushing and Breskens was made in a larger ferry boat that had a screw at each end, and the crossing was far more comfortable than on the outward journey. At Breskens I was amazed to see about 600 vehicles waiting for passengers from the boat. After a terrific scramble we found our coach, and except for a long wait at the frontier in a line several miles in length of cars awaiting examination by the Customs authorities, we reached our destination without further incident.

E. MARSHALL (Ealing Common).

Native costumes in Holland, a market day scene in Middelburg, on the island of Walcheren.

Old French Fort in Canada

Two years ago, while living in Montreal, I visited St. Helen's Island, which is in the River St. Lawrence and is directly opposite the city. My purpose was to inspect the remains of the fort built on the island by the early French settlers. This was rectangular in shape, with an arched gateway at each end. A few years ago the side of the fort nearest the river was considered unsafe and demolished; the remainder I found to be nearly intact, but in a dilapidated condition. Near it is an enclosure surrounded by a wall, and in the centre of this is the old powder magazine of the fort.

The island was the scene of historic events in the 18th century, for Montreal was surrendered to the British in 1760, a year after the capture of Quebec by Wolfe's army. The Marquess de Vaudreuil, Governor of Montreal, burned his colours to prevent their falling into the hands of the British when the fort was surrendered. Several of his cannon are still to be seen on the island. Two face the city of Montreal, and two more stand by the side of a small blockhouse at the rear of the fort that originally was intended for defence against Indians. N. C. MEACHEM (Birmingham).

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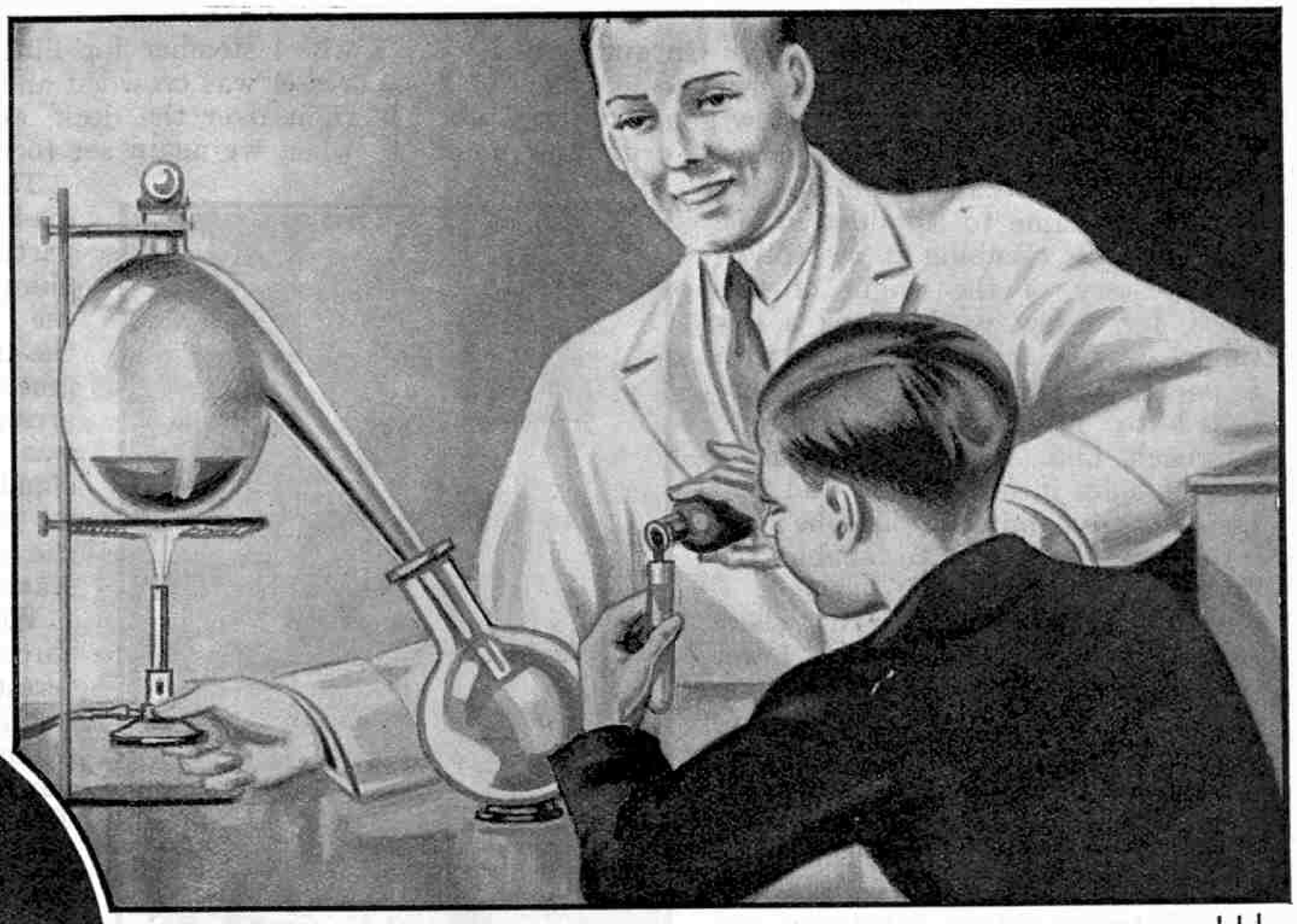

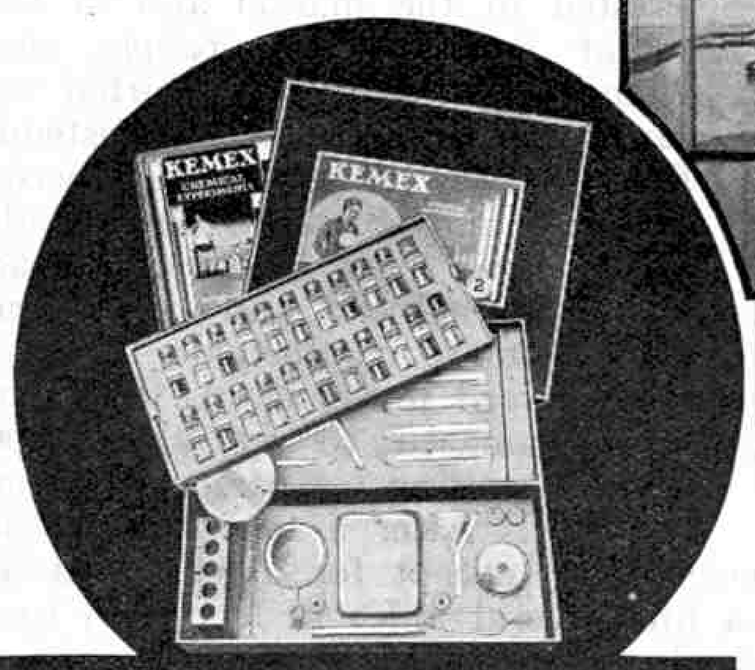

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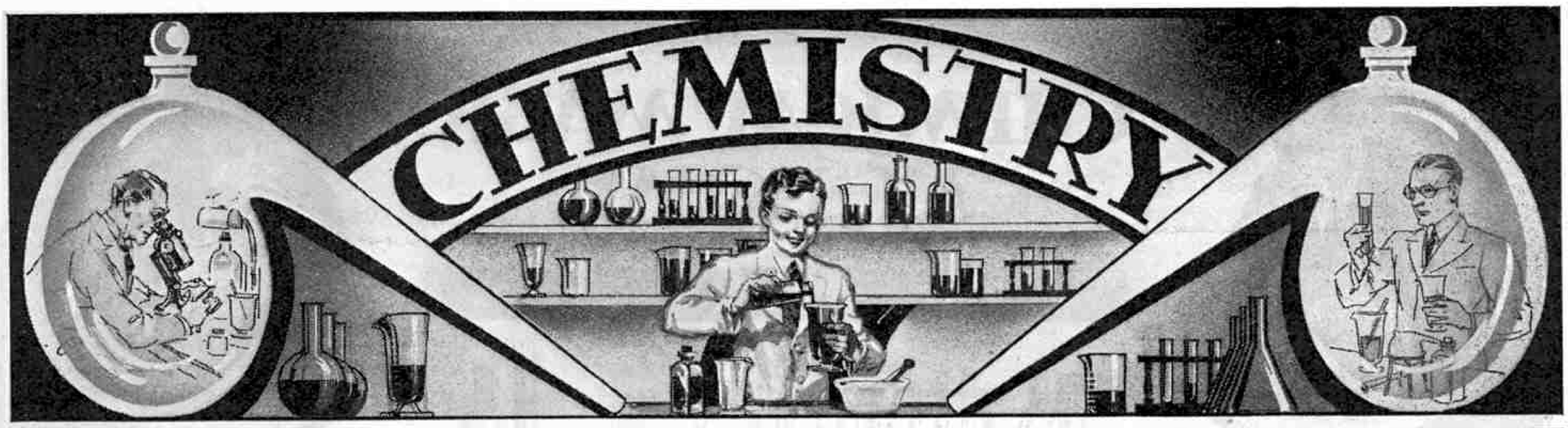

CHEMISTS WHO TRIED TO MAKE GOLD

IN many respects the most mysterious figures of the Middle Ages were the alchemists, one of whom is shown in the accompanying illustration at work in his laboratory, surrounded by the furnaces, retorts and other apparatus used in his experiments. The alchemists were regarded as magicians by the ignorant peoples of their times. They earned this reputation by their efforts to make an elixir that would confer the gift of eternal life on those who drank it, and a liquid that would dissolve everything; and by their endeavours to bring about the transformation of lead, tin, copper and other base metals into gold.

Naturally the greatest general interest in the activities of the alchemists was centred in their efforts to transform all metals into gold, for success offered an easy way of becoming incredibly rich. The dream of the transmutation of metals seems to be a very old one, but the search for the Philosopher's Stone, which at a touch would transform metals into gold, and for other means of bringing about this remarkable change, became most intense in the later Middle Ages. It was then thought that tin, lead, copper and other metals contained a special metallic principle mixed with different proportions of earthy matter or dross, and that the removal of this impurity would yield gold, the one pure and noble metal. Silver was regarded as less noble than gold, but superior to the baser metals because it contained a smaller proportion of earthy impurities. Acting on this belief alchemists dissolved the metals in acids, subjected them and their compounds to intense heat in crude furnaces, and generally tortured them in the hope of finding a residue of pure gold in the flasks and crucibles in which these operations were carried on.

An alchemist carrying out mysterious experiments in his laboratory. His assistant is tending a furnace on which a retort is being heated.

Needless to say, the alchemists were doomed to disappointment, and after centuries of efforts it was realised that it was hopeless to attempt to transform other metals into gold. As might be expected, however, the story of the centuries during which they pursued their endeavours is full of instances of imaginary success. Many alchemists died in the belief that they had actually achieved the transmutation, but in practically all these cases they had been deceived by changes of colour, and the " gold " they had produced was simply a worthless yellow compound or alloy.

Even more remarkable than the manner in which alchemists deceived themselves was the ease with which wealthy people were persuaded to part with money to imposters who pretended that they had discovered the great secret. Swindlers of this kind indeed became so numerous that a German bishop is said to have kept a special gallows for the benefit of rogues pretending to be successful alchemists!

These frauds took many forms. In many instances gilded bars of lead were represented as the products of alchemical operations and sold for far more than their true value. A favourite device was to allow the credulous victim to find a small fragment of gold in one of the vessels employed in a trial experiment on a small scale. Encouraged by this he then cheerfully provided the funds necessary to carry out similar operations on a larger scale, and cherished the belief that at last he was about to become immensely rich. Even when the so-called alchemist disappeared with as much money as he had been able to extract, the unfortunate dupe could not always be persuaded that the gold he had seen had been smuggled in for the purpose of deceiving him!

All alchemists were not rogues, of course, and those who made serious experiments added greatly to our knowledge of chemistry by carefully studying the composition of things and the manner in which they re-acted upon each other. This led to the abandonment of all ideas of transmutation, for it was then realised that gold was always gold, and tin always tin. The metals, in fact, became recognised as typical elements, or simple forms of substances that could not be split up further and always remained entirely distinct from each other. The number of these elements known has grown steadily until 91 are recognised.

Each element was supposed to be built up from atoms or tiny indivisible particles that are far too small to be seen, so small indeed that there are thousands of millions of various kinds of atoms in a single drop of sea water. The atoms of any element are alike in weight and size and in their likes and dislikes, and the atoms of any one metal differ from those of any other metal in these respects. For instance, the atoms of copper are heavier than those of zinc. Further, every atom of zinc placed in hydrochloric acid eagerly seizes upon an atom of chlorine, one of the constituents of that chemical, to form a new compound. On the other hand, atoms of copper have little liking for those of chlorine, and therefore nothing happens when hydrochloric acid is poured over this metal.

Until the beginning of the present century chemists remained confident in the belief that at last they had solved the problem of the nature of the materials that compose the earth, for they believed these to be built up from the elements they had discovered in them. They even learned to recognise that the same elements were present in the Sun, and in the most distant stars from which light reaches us.

Then came a bombshell, for it was suddenly revealed that the so-called simple substances are in reality very complex, for their atoms are built up from even simpler constituents. Most surprising discovery of all, these bricks of which the atoms are built are only two in kind. They are known as the electron and the proton. The electron is simply a unit of negative electricity; the proton is a heavier mass with an electrical charge equal and opposite to that of the electron. As both are to be found within a tiny atom, they are incredibly small, and if an atom containing one of each were magnified to the size of a large cricket field, the proton could be represented by a small ball placed in its centre, and the electron by a speck of dust. To complete the picture, which would represent an atom of the well-known light gas hydrogen, the speck of dust would have to be imagined to be running round the boundary, for the electron in a hydrogen atom is thought

Continued on page 928)

COLOURED PRECIPITATES AND CHEMICAL GARDENS

IT is always a great surprise to those unfamiliar with chemistry to find that in many cases mixing two clear solutions results in the production of a dense solid, especially when this is brilliantly coloured. The field for experiment in this direction is very wide for every owner of a Kemex Outfit, for many well-known and familiar substances readily yield precipitates, as solids formed in this manner are called. Lead Nitrate is an excellent example. A solution of this is readily prepared by dissolving four measures of the crystals in half a test tube full of water, hastening the process by warming, as explained in last month's article. When cool, the solution is divided into two equal portions, and to these are added solutions of Magnesium Sulphate and sodium carbonate, or washing soda, prepared in a similar manner.

In each case a very dense white precipitate of an insoluble lead compound is obtained. The first of these precipitates is lead sulphate. The second is a form of lead carbonate, the chemical known to plumbers and painters as white lead. This is of importance in the paint industry, for paint containing it possesses to an extraordinary degree the power of "covering" the surfaces over which it is brushed, but is liable to become yellow or brown when exposed to air containing traces of sulphur. Lead sulphate is sometimes preferred for making white paint, although its covering power is less than that of white lead, because it has the advantage of retaining its colour better.

Two other compounds of lead that can be prepared by precipitation are of special interest. A solution of Lead Nitrate is prepared as already explained, and again divided into two parts To one of these a similar solution of common salt is added, and immediately a white precipitate is formed. This is lead chloride, formed by an interchange between the salt, or sodium chloride, and lead nitrate. Sodium nitrate, the other product of the change, is soluble in water and therefore is not precipitated.

So far the experiment has proceeded along the lines of those already described, but if the liquid is heated, the precipitate slowly disappears, for lead chloride dissolves readily in hot water. It again separates out when the test tube containing the solution is placed on one side to cool, and this time it is in the form of glittering white crystals. This mysterious disappearance and reappearance can be brought about repeatedly.

All the precipitated compounds of lead so far dealt with have been white, but the addition of a few drops of Potassium Iodide solution to the remainder of the solution of Lead Nitrate gives a precipitate that is bright yellow in colour. This is lead iodide, a chemical that in many respects resembles lead chloride, for it dissolves when the temperature is raised, and again separates out in the form of glittering golden-yellow crystals on cooling. Those who possess a good magnifying glass or a microscope will find it great fun to filter the liquids containing the crystals of lead chloride and lead iodide prepared in this manner, and to examine the residues on the filter papers. Both chemicals form flat crystals, but those of the chloride are longer and narrower than the yellow crystals of lead iodide.

Amateur chemists carrying out precipitation experiments are liable to get surprises from unexpected results. For instance, if household ammonia is added drop by drop to a solution of Copper Sulphate, made by dissolving two measures of the crystals in a third of a test tube full of water, a light blue precipitate of copper hydroxide is formed as each drop enters. If the experimenter continues to add ammonia, perhaps expecting to precipitate the whole of the copper contained in the solution, he is suddenly startled to find that the precipitate already formed has disappeared and in its place the test tube contains an intensely blue solution. The ammonia has swallowed up the precipitate it has itself produced!

The depth of colour of the solution formed in this manner is of great interest, for the presence of the merest trace of copper is sufficient to give an intense blue colour on the addition of ammonia. It is interesting to try experiments with solutions of Copper Sulphate so dilute that their colour can scarcely be detected. In these tests, it is best to use small quantities of liquid. An excellent plan is to add a drop or two of Copper Sulphate solution to water to a depth of about half an inch in a test tube, and to add one or two drops of ammonia to half of this solution, poured out into a second test tube. This enables the change in the shade and intensity of the colour to be realised by direct comparison.

The analyst sometimes makes use of this test, which is so delicate that it enables him to detect the presence of copper in solutions containing as little as one thousandth of one per cent. of copper.

Experiments in which one metal displaces another from solution are interesting examples of precipitation. For instance, copper can be displaced from Copper Sulphate solution by boiling the liquid with Granulated Zinc or Magnesium, when the copper is precipitated in the form of a brown powder; or even by dipping the clean blade of a penknife into the liquid, when the steel is covered with a brown coat of the displaced metal that can easily be scraped off.

In one very attractive experiment of this kind the metal turned out of solution actually appears in the form of crystals. This happens when lead is precipitated by Granulated Zinc. A solution of Lead Nitrate is made by dissolving six measures of the chemical in three-quarters of a test tube full of water. A large piece of Granulated Zinc is then tied at the end of a length of string, and similar pieces are fixed above it on the string at intervals of about an inch. The chain of fragments is suspended in the solution of Lead Nitrate, by attaching the string to a piece of wood

Fig. 1. Precipitating salt from solution by passing hydrochloric acid gas into it. The salt is obtained in a pure form that does not become damp when exposed to moist air.

Fig. 2. A Chemical Garden grown by placing crystals of Cobalt Nitrate in a solution of water glass.

placed across the mouth of the tube, which is then placed upright in a position in which it will not be disturbed.

A few hours later the pieces of Zinc will be found to be covered with small glittering flat crystals of lead. They are deposited on the zinc itself, for the lead is displaced where the metal comes into contact with the solution of Lead Nitrate, and as the experiment proceeds the crystals spread outward in fantastic shapes to form what is often described as a lead tree.

Owners of the No. 3 Kemex Outfit will have no difficulty in proving the displaced metal to be lead. For this purpose the glittering crystals are dried and heated on the charcoal block by means of the blowpipe, the nozzle of which is held just outside the flame. The lead melts to form a small bead, and some of it burns to form yellow lead oxide, which is deposited on the charcoal.

One of the most interesting precipitates that can be prepared is common salt. The fact that this well-known chemical can be precipitated will come as a great surprise to most readers, for it is readily soluble in water. In this case the precipitation is brought about by changing the liquid in which salt is held in solution by adding hydrochloric acid to it. By preparing this chemical in the form of a gas and passing it into a solution of salt, the experiment may be made to take a very interesting and attractive form.

A mixture of ordinary salt and Sodium Bisulphate is placed in a clean dry test tube fitted with a small bored cork, through which passes the small right angle delivery tube. The rubber connection tube unites the lower end of the delivery tube to the thistle funnel, as shown in Fig. 1, and the wide end of the funnel dips just below the surface of the solution of salt from which the precipitate is to be obtained. This solution may be placed in the wide-necked flask, the evaporating dish, or some other suitable vessel, and is prepared by dissolving as much salt as possible in half a test tube full of hot water, and pouring off the liquid after allowing the tube and its contents to cool.

When all is ready the mixture of salt and Sodium Bisulphate is steadily heated by passing the flame of the Spirit Lamp backward and forward underneath the tube containing it. The hydrochloric acid gas given off dissolves in the salt solution with which it comes into contact, and as it does so, a miniature shower of tiny white particles of salt driven out of solution make their appearance at the surface of the liquid inside the thistle funnel, and then fall slowly to the bottom of the vessel containing the salt solution. The heating is continued for about ten minutes, or even longer if salt continues to be precipitated. During this time a few bubbles of hydrochloric acid gas may escape and their presence will be revealed by a slight mist in the moist air in the flask.

At the end of the experiment a layer of white salt is found at the bottom of the liquid in which the gas has dissolved, forming an acid solution that turns litmus red. The salt is readily separated by filtering, and while it is in the filter paper a few drops of cold water are poured through several times in succession in order to wash away the acid. The solid remaining can then be shown to be salt by tasting it.

As in the case of the lead chloride and lead iodide precipitates already mentioned, it is interesting to dry the salt obtained in this experiment, and to examine the particles with the aid of a magnifying glass or microscope if one is available. It is then seen to consist of tiny cubical crystals. This salt is scraped off and thoroughly dried by gentle pressure with filter paper and slight warming. It will not become damp, as some samples of ordinary salt are liable to do. The reason for this is that it is pure, while some samples of commercial salt contain traces of magnesium compounds that absorb water from the atmosphere, causing them to become moist.

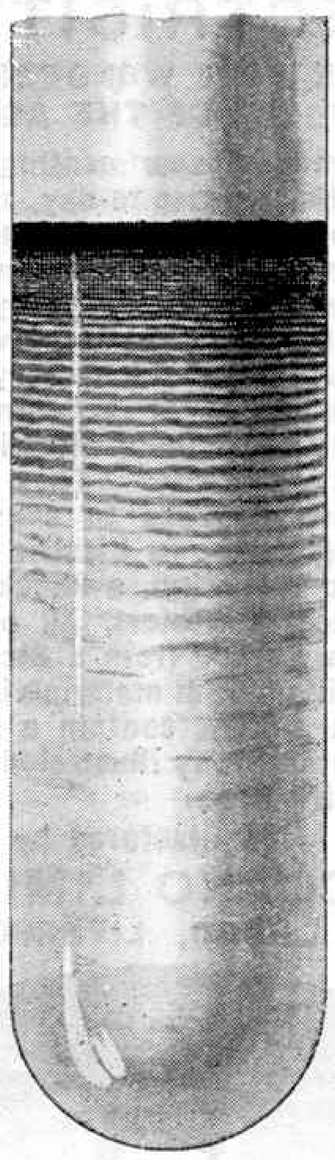

Fig. 4. A fine example of rhythmic precipitation.

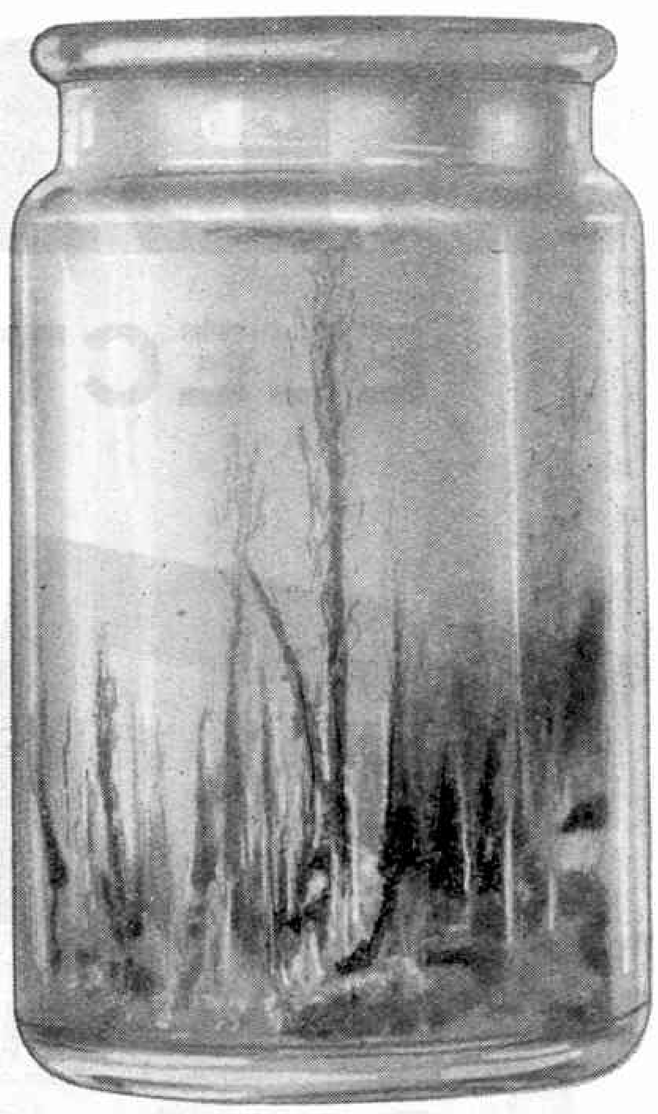

Fig. 3. The growths obtained when Copper Sulphate, Magnesium Sulphate and other chemicals are placed in water glass show remarkable differences in form and colour.

A splendid series of brightly-coloured precipitates can be made by adding a dilute solution of Sodium Ferrocyanide to solutions containing Iron Alum, Copper Sulphate, Nickel Ammonium Sulphate, Cobalt Sulphate, and Manganese Chloride, all of which are included in the range of Kemex parts. Each of these solutions is made by dissolving one or two measures of the required chemical in one-third of a test tube full of water, and in each case a few drops of a solution of Sodium Ferrocyanide in the proportion of four measures to half a test tube full of water is added in order to produce the desired effect. The colour change in the case of Iron Alum is almost startling, for the precipitate in this case is the intensely deep blue dye known as Prussian Blue.

Remarkably interesting precipitation experiments can be carried out when one of the chemicals concerned is in the form of a jelly. About quarter of an ounce of gelatine will be sufficient for a series of trials, and this may be obtained for a few pence from a chemist. It is placed in a small basin and over it is poured five ounces of boiling water. The gelatine quickly dissolves, especially if it is well stirred with the glass rod, and the solution sets to a moderately stiff jelly when cold.

Before the jelly is allowed to cool, however, the chemicals required for the experiments must be added to it. Suppose that we are precipitating Prussian Blue in this manner. A few very small crystals of Sodium Ferrocyanide are placed in a clean dry test tube, and warm gelatine solution is then poured in until the vessel is about two-thirds full. The chemical dissolves and the tube is then placed upright in a position in which it will not be disturbed until the gelatine sets. When this happens, a pinch of Iron Alum is dissolved in water to a depth of half an inch in a second test tube, and the clear liquid resulting is poured on top of the jelly. On standing, the Iron Alum in the solution works its way slowly but steadily into the jelly, where it comes into contact with the Sodium Ferrocyanide to form a blue layer containing the precipitate. This layer slowly increases in depth as the Sodium Ferrocyanide penetrates into the jelly and it is interesting to watch the lower edge of the deep blue band creeping lower and lower down the test tube day by day in this slow-motion form of precipitation.

A particularly interesting result follows the use of potassium bichromate, or bichromate of potash, a small quantity of which can be purchased from a chemist if it is not already available. The amount of this to be added to the gelatine solution must be only just sufficient to give it a faint yellow tinge. When the jelly containing this chemical is set, a solution made by dissolving a pinch of Lead Nitrate in water to a depth of one inch in a test tube is poured over it and the tube set on one side.

As in previous experiments of this type, the upper solution slowly diffuses into the jelly, and forms a precipitate as it comes into contact with the chemical in it. In this case the precipitate is lead chromate, and is bright yellow in

(*Continued on page 884*)

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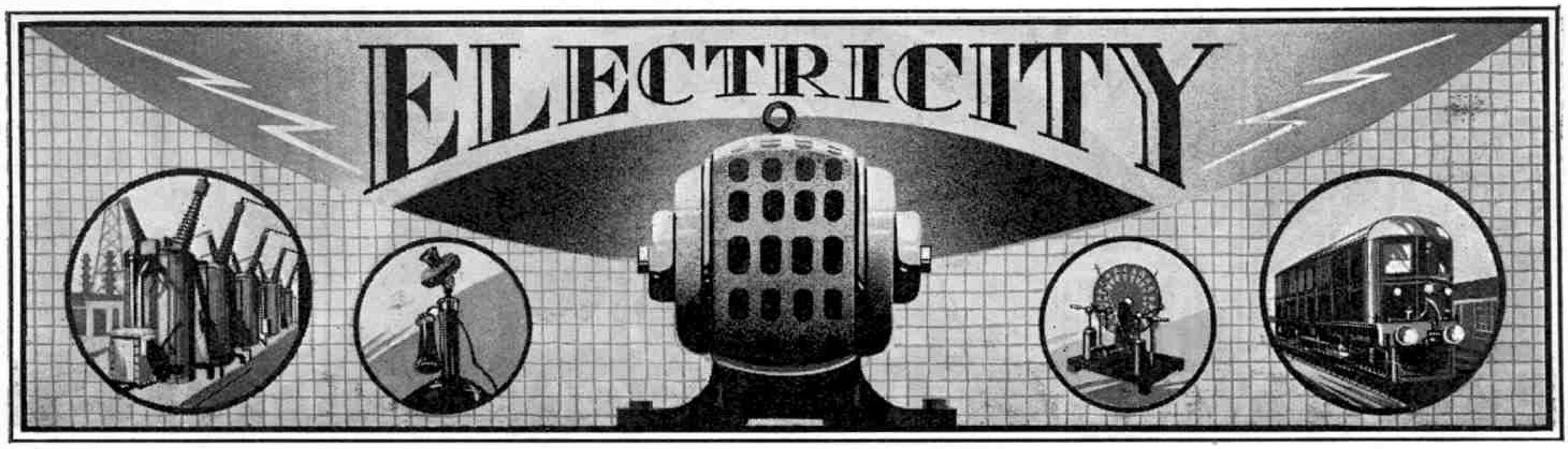


ELECTRIC EYE THAT COUNTS AND CHECKS TRAFFIC

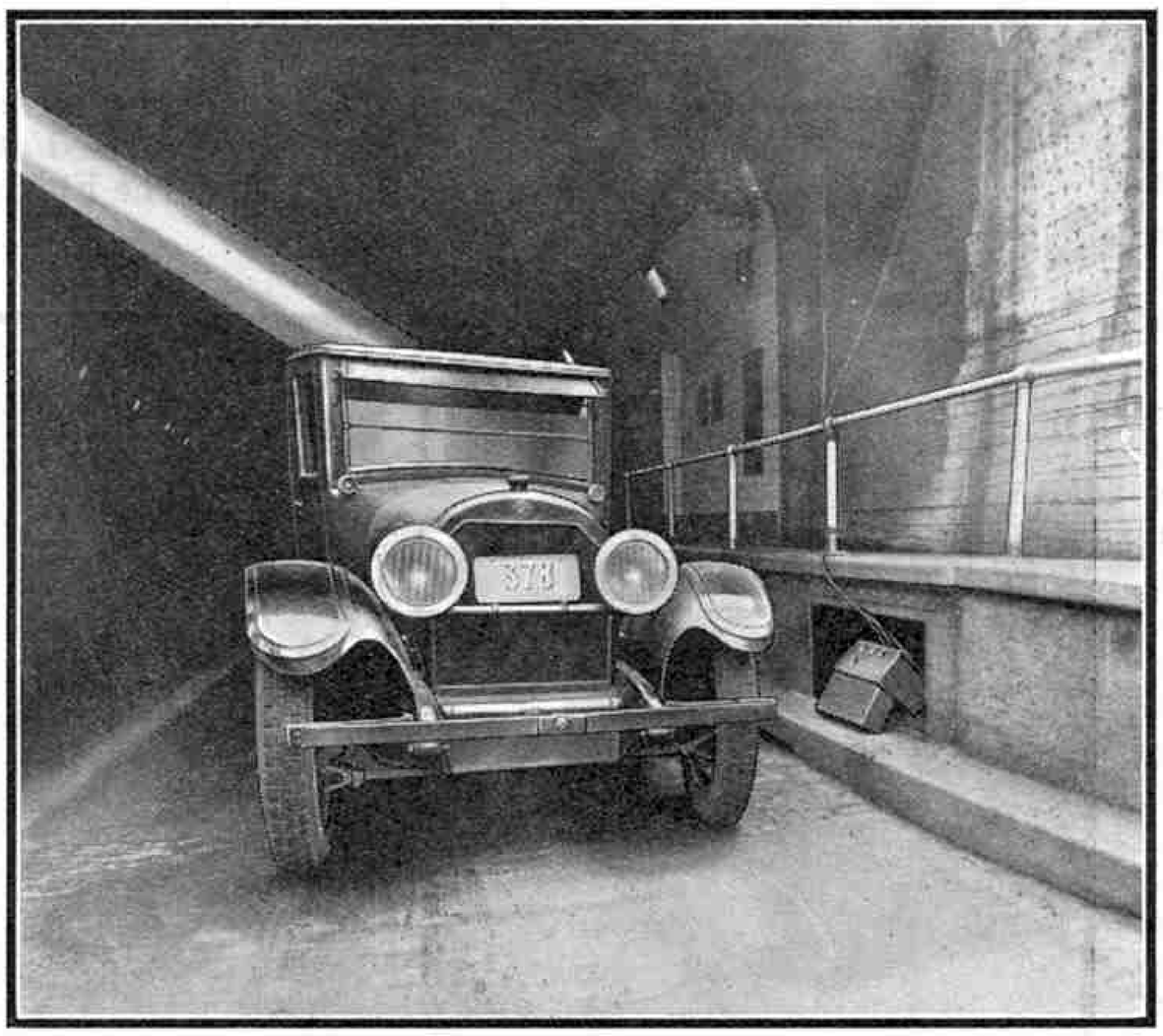
ONE of the most remarkable of recent electrical developments has been the introduction of the photo-electric cell. This is simply a vacuum tube of some suitable shape in which there are two electrodes—a positive electrode, or anode, of nickel wire, or a similar material; and a negative electrode, or cathode, usually consisting of a coating of silver on the inner surface of the glass bulb itself, over which a thin layer of metallic potassium has been deposited. The two electrodes are connected with external terminals by means of which the cell is included in an electric circuit, and a very small quantity of argon, an inert gas, is introduced into the cell, for the presence of this gas makes it more efficient in the performance of its special duties.

The central feature of such a cell is the potassium of the cathode, for this shoots out electrons, or tiny particles of negative electricity, as soon as light falls upon it. These electrons are immediately attracted by the anode, for this is connected to the positive terminal of the source of electric current employed, and stream across the cell towards it. Thus they constitute an electric current of exactly the same kind as that flowing through a wire connected to the terminals of an accumulator, for we now know that an electric current is simply a stream of electrons. No current can cross the cell until the electrons are released by the action of light, but as soon as this happens the circuit that includes the photo-electric cell is complete. Current therefore flows through it and continues to do so until the light exciting it is cut off.

Because of its instant response to the flashing of a beam of light upon it, the photo-electric cell has been called the "electric eye," and an amazing variety of interesting uses has been found for this wonderful device. One of the most remarkable of these is illustrated in the photograph reproduced on this page, which shows a photo-electric cell counting the vehicles passing through the Holland Tunnel under the River Hudson at New York. The box containing the cell used for this purpose is placed beneath the sidewalk on one side of the roadway. On the opposite side is a small floodlight mounted upon the overhead ironwork of the tunnel in an inclined position, so that its single beam of light passes through a little circular window in the box.

While the light shines upon the photo-electric cell, the electrons stirred into action by it pass freely across the tube from the cathode to the anode. The electric circuit in which the tube is included is therefore complete, and current flows through it. As soon as a vehicle passes in front of the box, however, the electric eye cannot "see" the beam of light, and the flow of electrons across the space between its electrodes is momentarily checked. The sudden decrease in the current brings an electrical relay into action. This acts like a switch, sending an electrical impulse through an amplifier, which communicates it in magnified form to registering instruments in the administration buildings of the tunnel authorities. Every interruption of the beam is registered on the dials of these instruments, and thus the number of vehicles passing in front of the electric eye during any given period is counted automatically.

Unlike human counters, the electric eye never tires so long as the supply of current required for its operation, and for that of the amplifier associated with it, is maintained. Night or day it is able to respond instantaneously to the impressions made upon it by the passage of motor cars and other vehicles, and to act with complete accuracy and reliability, whatever the speed at which cars are driven past it.



The "electric eye" recording the passage of a motor car through the Holland Tunnel, New York, when the vehicle interrupts the beam of light falling upon it. For this photograph we are indebted to the General Electric Company of New York.

The information given by this remarkable electric counter makes it possible to keep a check on events in the tunnel. For instance, suppose that electric eyes are installed at intervals along the great underwater tube, each with its own dial to indicate what it sees. If the number of vehicles leaving any one section then suddenly decreases, without a corresponding decrease in the number entering it, something must have happened to cause a stoppage. Special means could then be taken to regulate the supply of fresh air in order to prevent the accumulation of poisonous gases shot into the atmosphere by motor car exhausts, and to discover and remove the cause of the trouble. An emergency of this kind can be dealt with very quickly because the electric eye gives practically instantaneous warning.

It is easy to realise other uses that may be made of this wonderful invention, and during the last few years an astonishing number of applications of many different kinds have been worked out. With its aid articles of all kinds are counted at speeds up to 350 a minute as they move along travelling belts; doors are opened automatically at the approach of those who wish to pass through; and the device has even been installed as a precaution against damage from fire, and to check the efficiency of stoking in boiler houses by literally keeping an eye on the smoke that passes up the chimney. It also can be made to respond to invisible infra-red light, and then can be employed as an unseen barrier for the protection of valuables.

The electric eye is also employed to ensure the safety of operators of presses and similar machines. In these cases the beam of light is so placed that it is interrupted by the operator's hand when this is placed in a dangerous position, and the effect is to stop the machinery instantaneously. More remarkable still, the circuits can be so designed that this only happens if the upper part of the press is on its downward stroke, thus leaving the operator free to place new material in position while the mass of metal is moving upward, and therefore is not threatening danger.

ELECTRIC SHOCKS FOR AMUSEMENT

EVERY boy is fascinated by the ability of a magnet to attract objects of iron and steel from a distance, and this fascination can be shared to the full by owners of Elektron Outfits, who are able to carry out many attractive and interesting experiments with the powerful Bar and Horseshoe Magnets included in the range of Elektron Parts. We referred last month to the splendid magnetic maps that can be made with their aid, in the manner explained in the Elektron Manuals, but these and the other experiments then described do not by any means exhaust the fun that may be obtained from the Elektron Magnets.

One of the most remarkable features of magnetic force is its ability to pass through any obstacles, except those made of iron or steel or other magnetic material. This is shown readily by moving the Bar Magnets about with one pole touching the lower side of a sheet of paper or card on which iron filings have been sprinkled. The position of the pole is instantly revealed by the behaviour of the filings, for those directly above the pole always stand up on end, instead of lying down peacefully. They respond instantly to the magnetic force the pole exerts through the card or paper, jumping up when it approaches them, and falling down again when it has passed by.

This peculiar property of magnetism lends itself readily to the production of effects that at first sight appear very mysterious. For example, the owner of an Elektron Outfit can draw a nail on a sheet of thin card in such a realistic manner that a key can be hung on it! Our first illustration shows this astonishing feat being carried out. The secret lies in the employment of a Bar Magnet at the back of the card, the nail being represented by a small circle drawn on the front. The Magnet, which is held in position by the thumb of the owner of the Outfit, is placed vertically, with one pole just below the edge of the card and the other lower down. The circle is drawn in front of the lower pole, and a few trials will enable the experimenter to place it exactly in the position where the magnetic attraction through the card is greatest.

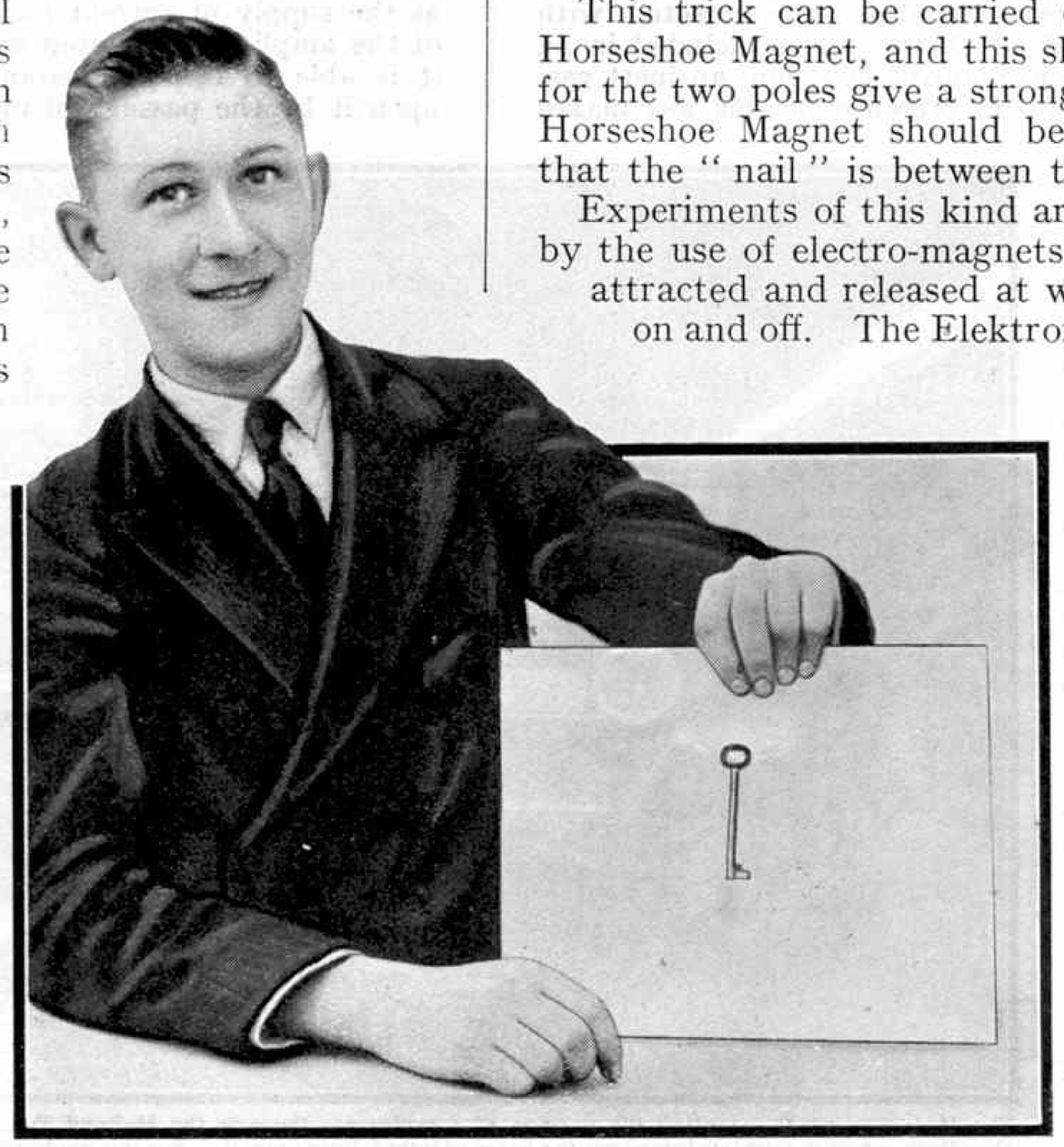


Fig. 1. A key that hangs on a nail drawn on a sheet of thin card! The apparent miracle is the work of a magnet carefully concealed behind the card.

This trick can be carried out even better with the Horseshoe Magnet, and this should be used if available, for the two poles give a stronger hold on the key. The Horseshoe Magnet should be held in such a position that the "nail" is between the two poles.

Experiments of this kind are made still more striking by the use of electro-magnets, for then objects may be attracted and released at will by switching a current on and off. The Elektron Outfits give a wide range of electro-magnets. The simplest consists of a single Magnet Coil, which acquires magnetic powers when current is passed through its windings. A small nail resting with one end on the table, and with its other end inside the coil, is immediately attracted when current is switched on from a Bichromate or other cell, as shown in Fig. 3, and the nail jumps up into the coil itself, falling back again immediately the Switch is released and the flow of current stopped. In another attractive form of this experiment the coil is held horizontally, and a small needle is inserted partly inside the coil. As soon as the current is switched on the needle is pulled completely into the coil by the magnetic force suddenly called into being. If a very small and light needle is used for this experiment it can be made to shoot out at the opposite side of the coil.

In experiments in which Magnet Coils are employed it is best to make use of the Magnet Cores whenever possible. These Cores consist of pieces of soft iron that fit inside the Magnet Coils. The burr at the threaded end of the Core enables it to grip the bakelite moulding on which the Magnet Coil is wound, and it should be steadily pressed in until the opposite end is flush with the Coil moulding. In this position the Core concentrates

within it the lines of magnetic force generated when the current is switched on, and thus in effect becomes a powerful bar magnet.

The electro-magnet built up in this manner can be used instead of the Bar Magnet or the Horseshoe Magnet for the interesting trick illustrated in Fig. 1, for the Magnet Coil is sufficiently small to be pressed by the thumb against the thin card employed. It holds the key firmly so long as the Switch is closed.

A horseshoe electro-magnet is easily made by using two Magnet Coils, each with its own Magnet Core, and joining the threaded ends of the two Cores by a piece of soft iron in order to give the right shape to the magnet. The various Yokes included in the Outfit are employed for this purpose, the choice being decided by the purpose to which the electro-magnet is to be put. In all cases, however, the inner ends of the windings of the Coils are joined together by means of the Wire Connector to enable the current to be passed through the two Coils in turn, and the ends of the Cores then become north and south poles respectively.

Fig. 2. It is practically impossible for anyone holding one Shocking Coil Handle to lift a coin out of water in which the other Handle is placed, so long as the Coil is working. The pulsating current numbs the muscles of his hand and arm and he is unable to grasp the coin.

The result of switching on current through the windings of an electro-magnet is strikingly shown by holding one of horseshoe shape, constructed in the manner already explained, with its poles upright, and resting on them a sheet of thin card or glass on which iron filings have been sprinkled, exactly as in making magnetic maps. The windings of the Magnet Coils are connected to the Bichromate Cell, and the Switch is included in the circuit. Pressing down the Switch key then apparently causes the iron filings above the poles of the electro-magnet to spring to life, for they immediately stand up on end, resuming their former positions when the key is released.

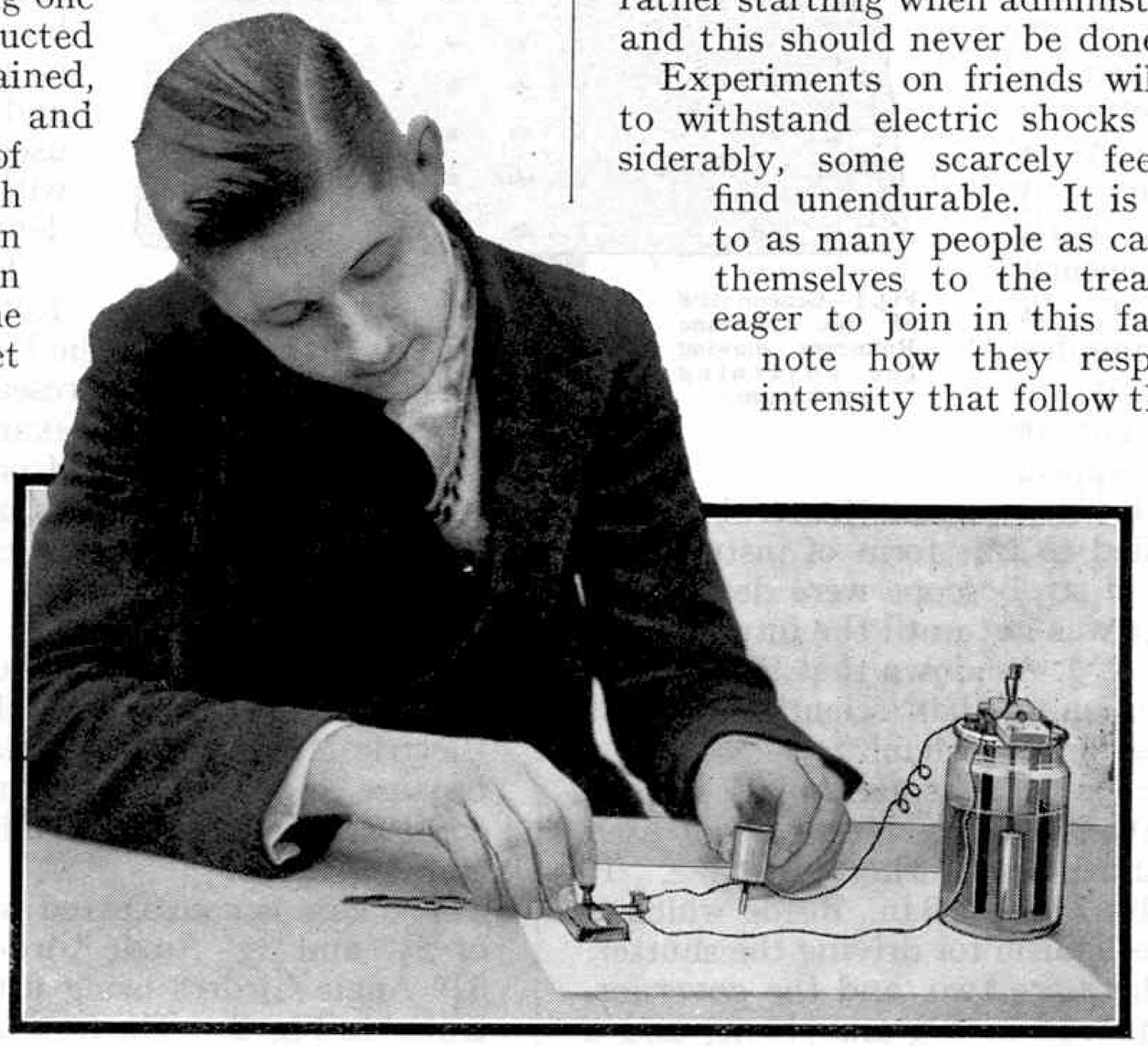


Fig. 3. A Magnet Coil pulling a small nail into its interior when the current is switched on.

The ease with which cores of soft iron can be magnetised and demagnetised in rapid succession, by switching on and off the current in the winding of the coils round them, enables many fascinating electrical devices to be built. An excellent example is the Shocking Coil constructed from parts included in the No. 1A and No. 2 Elektron Outfits, and this is a never-ending source of fun to owners of these Outfits and their friends. In this case a straight core is required. The innermost section of the Wound Bobbin employed therefore consists of a straight iron core surrounded by a coil in which current can flow in order to convert this temporarily into a magnet when required. This coil is the primary, and over it is wound a much larger number of turns of finer wire to form the secondary coil, through which flow the rapidly pulsating currents that actually give the shock to the victims of this device.

The owner of an Elektron Outfit will find it great fun to get a friend to hold one of the Shocking Coil Handles in each hand and to watch his contortions and grimaces when the current is switched on and he begins to feel the peculiar tingling effect in his hands and arms. To begin with, the brass Slide of the Wound Bobbin should be pushed well in, and it should be withdrawn slowly in order to increase the intensity of the shock little by little. Although there is not the slightest danger, the full shock is apt to be rather startling when administered without due warning, and this should never be done.

Experiments on friends will show that their ability to withstand electric shocks of this kind varies considerably, some scarcely feeling shocks that others find unendurable. It is interesting to give shocks to as many people as can be persuaded to submit themselves to the treatment—usually they are eager to join in this fascinating game!—and to note how they respond to the changes in intensity that follow the movements of the brass Slide. Touching the brass Handles nervously with the tips of the fingers seems to magnify the effect of the shock, and it is always best to grasp the Handles boldly and firmly. The state of the hands also affects the results, and it is interesting to compare the effect when the hands are moist with perspiration with that when they are carefully dried.

The fun of giving electric shocks with the Shocking Coil can be varied in many ways. For instance, it is interesting to send shocks through a chain of people—those at

(Continued on page 926)

A Meccano Rotoscope

Rapidly Moving Objects Made to Appear Still

UNTIL recently one of the many difficulties with which engineers were confronted was their limited knowledge concerning the peculiarities of high-speed machinery in motion. Some method of examining rapidly-moving objects was necessary in order to increase the reliability and safety of engines and machinery, particularly in the case of petrol engines and textile machines. It was not until the introduction of the Ashdown Rotoscope in 1926 that this difficulty was overcome.

The principle on which the Rotoscope operates will be understood best by carrying out a simple experiment. Look at a clock pendulum, but only open your eyes once for every second tick given by the clock. The pendulum will then appear to remain in the same position all the time. From this it will be seen that, if a wheel is rotated at high speed and a momentary glimpse of it is obtained once for every revolution it makes, the wheel will appear to remain stationary. By regulating the frequency of the glimpses the wheel may be made to appear to rotate slowly, so that any irregularities in its movement are readily seen.

The first successful attempt to examine moving objects in this manner was made by Ferdinand Plateau in the early part of the 19th century. Plateau discovered that, by looking through a revolving disc having a number of slots, it was possible to make turning or vibrating movements appear stationary. He named his instrument the stroboscope, a term that is still applied to this form of instrument. Many subsequent forms of stroboscope were devised by different inventors, but it was not until the introduction of the Rotoscope by Mr. A. J. Ashdown that the method of observation became of more than scientific interest and was applied to practical mechanics.

The Ashdown Rotoscope is a remarkably compact instrument, easily portable, and capable of being used as an extremely accurate measuring machine. It consists of a box $5\frac{1}{2}$ in. by 7 in. by 6 in., inside which is carried the clockwork mechanism for driving the shutter. The springs, of which there are two, and the governor, are similar to those employed in a gramophone, and a five-speed gear box is incorporated between the governor and the shutter. By careful adjustment a range of speeds between 500 and 20,000 r.p.m. may be obtained with a normal shutter, and by fitting special shutters a still wider range of from 50 to 250,000 r.p.m. is possible.

The shutter, which is of the rotary type, is a metal cylinder $4\frac{1}{2}$ in. in length and 1 in. in diameter, pierced by two slots through which the observer looks. There are four different types of shutter available, known as "bladed," "heteroptic," "displaced," and "hybrid" respectively. The bladed shutter is fitted with a number of thin steel strips, and enables a very short period of vision to be obtained. It has the disadvantage of reducing the amount of light passing through the slot, however, and in order to overcome this defect the heteroptic shutter was introduced. This consists of two cylinders, one revolving inside the other. The slots in this case are not bladed, but rely for their quick opening and closing action on the two sets of slots working in opposite directions.

In the displaced type of shutter the two slots are set at an angle of 90 deg. to each other, the slots being bladed as in the normal type. With this shutter objects may be successfully examined that have twice the speed of those with which the bladed shutter can be used. The hybrid shutter is a combination of the bladed and heteroptic types, and is used for giving high-speed vision with the greatest possible definition.

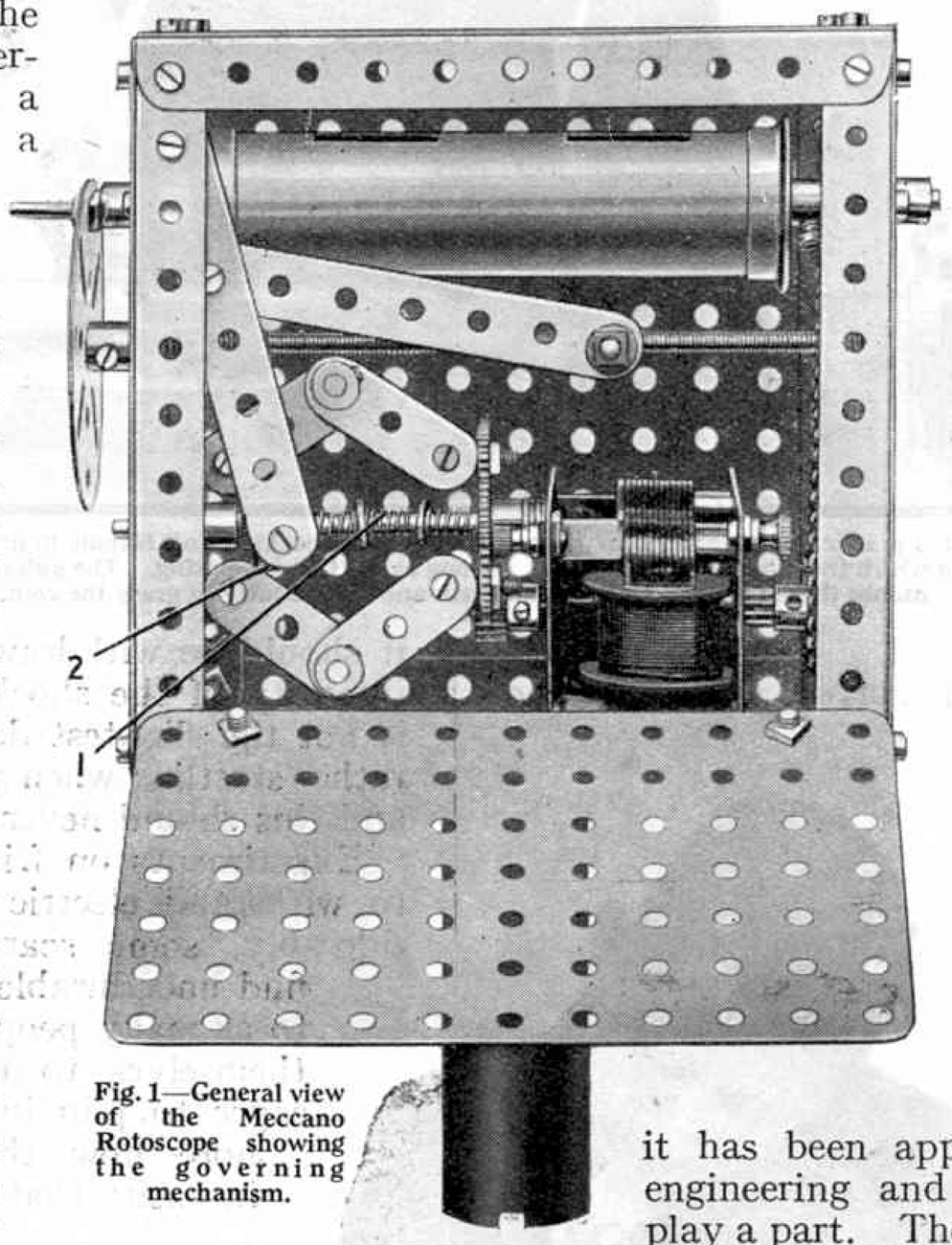


Fig. 1—General view of the Meccano Rotoscope showing the governing mechanism.

The sphere of utility of the Rotoscope is enormous, and it has been applied to almost every branch of engineering and research where moving objects play a part. The examination of gas jets and their flames, the effect of pressure-fed oil on chains, the study of chains and gears under varying loads, and the inspection of gramophones, printing machines and automatic telephones, are among the duties of this remarkable instrument.

The Meccano model Rotoscope is, externally, a close replica of the instrument already described, but an E1 Electric Motor is used in place of clockwork mechanism because of its simplicity and its high speed. Speed control is effected in a similar manner to that employed in the original.

The case is constructed by first building a framework of $5\frac{1}{2}$" and $3\frac{1}{2}$" Angle Girders as shown in Fig. 1, two $5\frac{1}{2}$" Angle Girders being fitted for an eyepiece, as illustrated in Fig. 2. The front and side $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plates are now fitted, the front plate being bolted in place immediately below the eyepiece. The back of the case is composed of a $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plate. This is attached to the model by means of two Hinges, and in this manner

the motor and controls of the shutter are always easily accessible. A small catch, consisting of a Flat Bracket mounted on a lock-nutted Bolt, may be fitted if desired to one of the corner $5\frac{1}{2}''$ Angle Girders, in order to prevent the inspection cover from falling open.

The top and bottom of the case consist of $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, the bottom Plate being fitted at its centre with a Bush Wheel. This Bush Wheel carries a 5" Rod in its boss on which is mounted a Wood Roller serving as a handle. A piece of rubber tubing slipped over this handle will add greatly to its appearance, and will also give the operator greater comfort and grip, points of considerable importance if long studies are to be made with it.

The motive unit, which consists of an E1 Electric Motor, is bolted to the Flat Plate forming the base of the model. A $\frac{3}{4}''$ Sprocket Wheel is carried on one end of the armature shaft, the other end being fitted with a $\frac{1}{2}''$ Pinion. A $3\frac{1}{2}''$ Rod is journalled in a top hole of one of the motor side plates, and also in a hole in one of the Flat Plates forming the side of the case. This Rod carries a 57-teeth Gear that is spaced away from the motor side plate by means of four Washers.

Two Handrail Supports are secured to this Gear in opposite holes, and they must be so arranged as to allow their plain holes to point towards the centre of the Gear.

Four Compression Springs and three Washers are now placed alternately on the Rod 1, the Washers being necessary in order to prevent the Springs from entwining. A Face Plate follows the Springs on to the Rod, and this is fitted with two Handrail Supports in a similar manner to those on the 57-teeth Gear Wheel. The Face Plate must be allowed to rotate freely on the Rod, and a Collar is placed between it and the side of the case.

The governor is now fitted, and this consists of eight $1\frac{1}{2}''$ Strips loosely attached to the Handrail Supports already mentioned. The connections are made by small screws taken from Universal Couplings, although Grub Screws will be suitable if others are not available. If Grub Screws are used, 1" Rods must be passed through the plain holes of the Handrail Supports in order to prevent the Strips from being gripped too firmly. The Strips are loosely connected together by 1" Rods and Collars at their end holes, Collars being placed between each set of Strips for spacing purposes.

When the Motor is run the Strips will fly outward, their movements being controlled by a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket 2 attached to a $3\frac{1}{2}''$ Strip. This Strip is lock-nutted to the model at its upper end, and to a second $3\frac{1}{2}''$ Strip at its third hole from the top. The loose end of this Strip is pivotally attached to a Handrail Support carried on a 6" Threaded Rod. This is held in position by a Collar on the inner face of the side plate and by a Face Plate on the outer face, the latter also serving as a control handle, a Threaded Pin being fitted in one of its outer holes for the purpose.

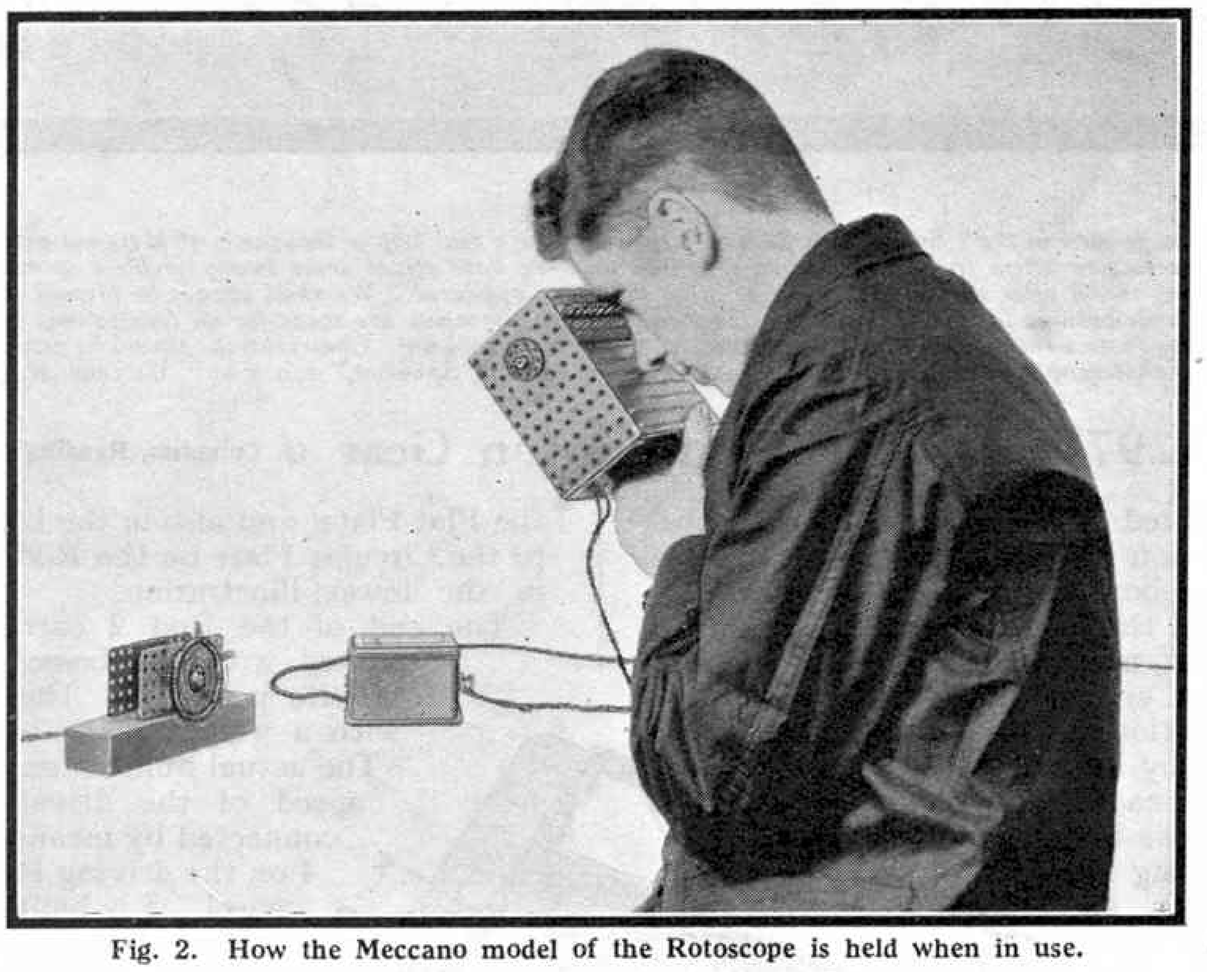
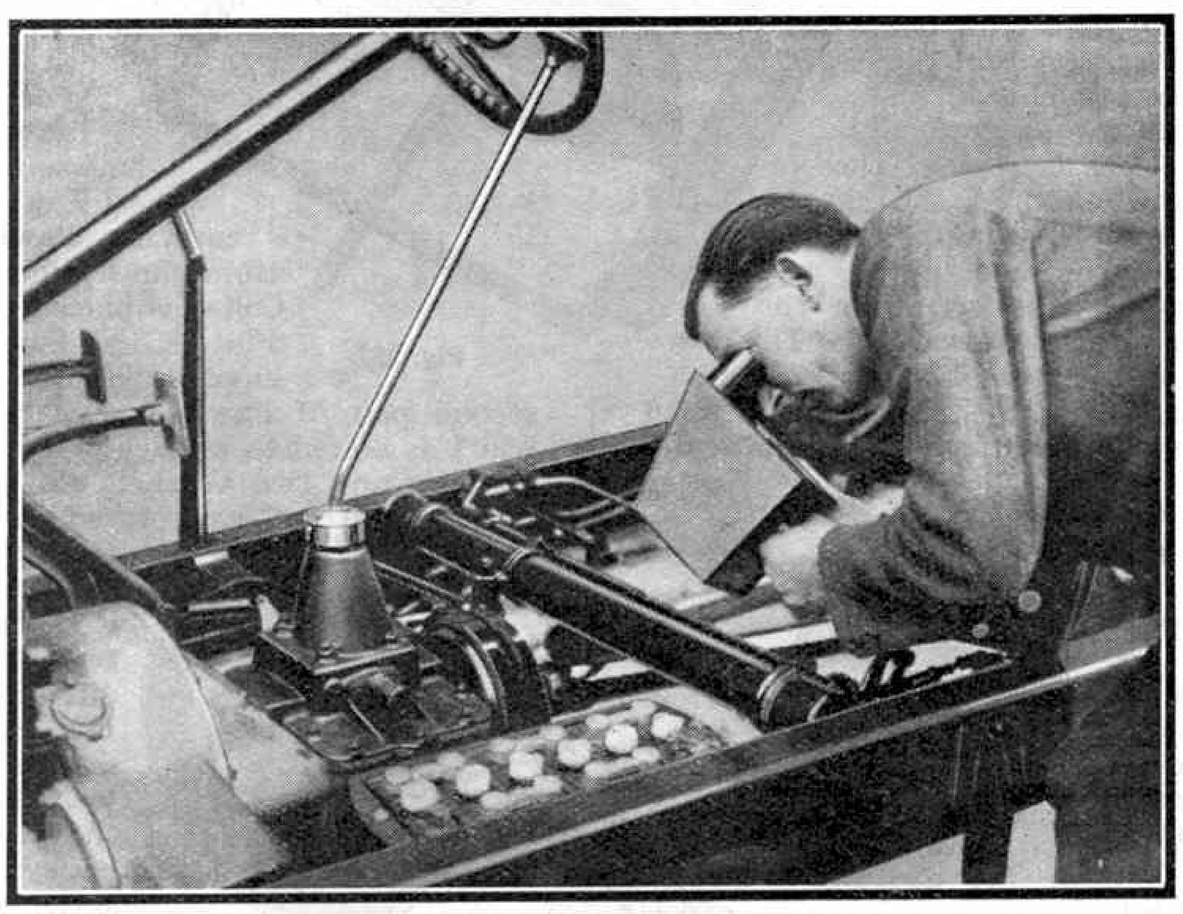


Fig. 2. How the Meccano model of the Rotoscope is held when in use.

The shutter now occupies our attention, and this is the most difficult part of the model. A piece of thin sheet iron or stiff cardboard is required, $4\frac{1}{4}'' \times 3\frac{5}{8}''$. Four slots, each $1'' \times \frac{3}{16}''$, are cut lengthways in the metal or cardboard, and so arranged that they are exactly opposite when the cylinder is formed. When these slots are cut the material is carefully bent to shape and a $1\frac{1}{8}''$ Flanged Wheel is passed over each end. These Wheels will be found to be a tight fit if the material has been measured correctly. The seam in the cylinder is now jointed by means of glue or solder according to the material used.

The complete shutter is carried on a $6\frac{1}{2}''$ Rod, journalled in the side plates of the model, on one side of which is mounted a $\frac{3}{4}''$ Sprocket Wheel. The drive from the Sprocket on the armature shaft is conveyed to this by a short length of Sprocket Chain. If required, the bearings carrying the shutter rod may be reinforced by the use of Bush Wheels.

When the model is completed all the bearings should be well oiled with fairly thin lubricating oil, and then be allowed to "run in." Better results will then be obtained owing to greater steadiness in the working parts.



The actual Rotoscope in use for the examination of motor car gear boxes.

The method of using the Meccano Rotoscope is shown clearly in Fig. 2. In order to carry out observations the motor should be first allowed to revolve at maximum speed, and then the control handle should be turned slowly in the retarding direction. In this manner the instrument is readily "tuned in" to the required frequency with the least possible variation in the speed of the shutter and motor.

Suggestions Section "Edited by Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(297)—Spontan Transmission Gear (J. Coombes, Reading)

In the July "*M.M.*" we illustrated a Meccano model of Hobbs' Inertia Gear, an ingenious invention intended to obviate the use of the motor car clutch and gear-box. In view of the immense interest created by mechanisms of this type, we illustrate on this page another extremely ingenious mechanism for automatically adjusting the gear ratio between engine and road wheels to suit varying conditions. The original mechanism was designed by Fredrik Ljungström, whose name will already be familiar to "*M.M.*" readers as the designer of the turbine locomotive bearing his name. The actual mechanism is an outstanding example of ingenuity, and although many working parts are necessary to obtain the required results, the device is neatly housed in a comparatively small casing bolted immediately behind the engine.

A car fitted with the Spontan Gear requires only one control in addition to the steering wheel and emergency hand brake. This takes the form of a foot pedal with a metal loop or strap into which the foot is inserted, so that the pedal can be depressed or raised at the will of the driver. Depression of the pedal releases the brakes, engages the clutch, and accelerates the engine, causing the car to gradually pick up speed as the engine revolutions increase. The pressure on the pedal governs the speed of the car, which is stopped by raising it to the neutral position, thus reversing the operations just mentioned.

To engage reverse gear, the pedal is raised from the neutral position and then pushed downward again. This causes the vehicle to start backward, the speed being governed once again by the pressure on the pedal, the gear ratio between the engine and the rear wheels being adjusted automatically as in the case of the forward drive.

To re-engage the forward gear the pedal is once more raised above the neutral position, and the car starts forward when it is pressed down again. An outstanding point in favour of the mechanism is that no skill is required for operating the foot pedal, which requires no delicate movement, and thus enables even a very inexperienced driver to control the car without difficulty.

The operation of the mechanism will be best understood by referring to the illustrations of the Meccano model shown in Figs. 297 and 297a. The lower illustration shows the different components before assembling. The working parts are housed in a frame consisting of two $7\frac{1}{2}''$ Angle Girders, between which are bolted four $4\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. These form bearings for the driving shaft 1, the intermediate shaft 2 (Fig. 297a), and the driven shaft 3. The Rod 1 carries a 4" Circular Plate that is bolted to a Bush Wheel and fitted with two 1" Screwed Rods 4 each held firmly in place by two nuts screwed tightly against the Plate. The $3\frac{1}{2}''$ Rod 2 is journalled in the Flat Plate, and also in the boss of the inner Bush Wheel bolted to the Circular Plate on the Rod 3. This Bush Wheel can be seen in the lower illustration.

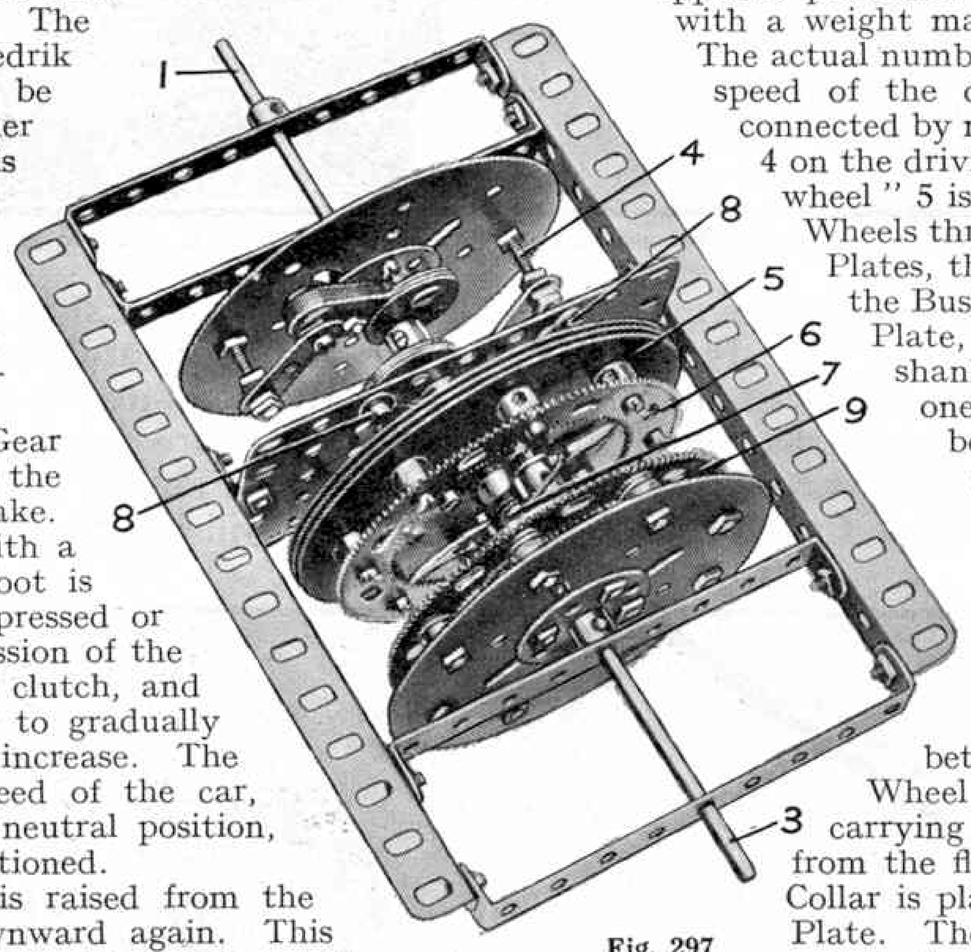


Fig. 297

The end of the Rod 2 carries two Single Throw Eccentrics mounted with the bosses facing outward and in directly opposite positions. The strap of each Eccentric is fitted with a weight made up of a number of Flat Brackets. The actual number used will depend upon the maximum speed of the driven shaft, and they are pivotally connected by means of $1\frac{1}{2}''$ Strips to the Screwed Rods 4 on the driving Plate. The flywheel or "pendulum wheel" 5 is built up by placing the bosses of Bush Wheels through the centre holes of two 4" Circular Plates, the two Plates then being mounted with the Bush Wheels inward on each side of a third Plate, and secured by eight $\frac{3}{4}''$ Bolts on the shanks of each of which are two Washers, one between each Plate. The same bolts hold the Gear Ring 6, which is spaced from the Plate by a Collar and Washer on each bolt. To the rear of the flywheel so formed lengths of Spring Cord are fitted, being attached by bolts 8 to the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate fixed to the frame.

The Rod 2 is free to rotate in the bosses of the two Bush Wheels mounted between the Plates, and carries the Bush Wheel 7, which is fitted with four Pivot Bolts carrying Pawls. The Bush Wheel is spaced from the flywheel 5 by means of Washers, and a Collar is placed between the wheel 5 and the Flat Plate. The Pawls on one side of the Bush Wheel engage the inside teeth of the Gear Ring 6, and the second pair of Pawls engage the teeth inside the Gear Ring 9, which is bolted to a Circular Plate by eight $\frac{1}{2}''$ bolts each carrying a Collar and two Washers for spacing purposes.

When the Rod 1 is rotated slowly, the connecting links attached to the Rods 4 cause the bob weights on the Eccentric straps to rotate round the Eccentrics. These unbalanced weights tend to turn the Eccentrics first in one direction and then in the other, the impulses increasing in intensity as the engine speed increases. This alternate to-and-fro motion is transmitted through the Rod 2 to the Bush Wheel 7, and backward rotation is damped out by the action of the Pawls on the flywheel 5, which is prevented from rotating by the Spring Cord. The spring-mounted wheel tends to smooth out the drive, and the reaction of the springs by which it is held assists the forward motion.

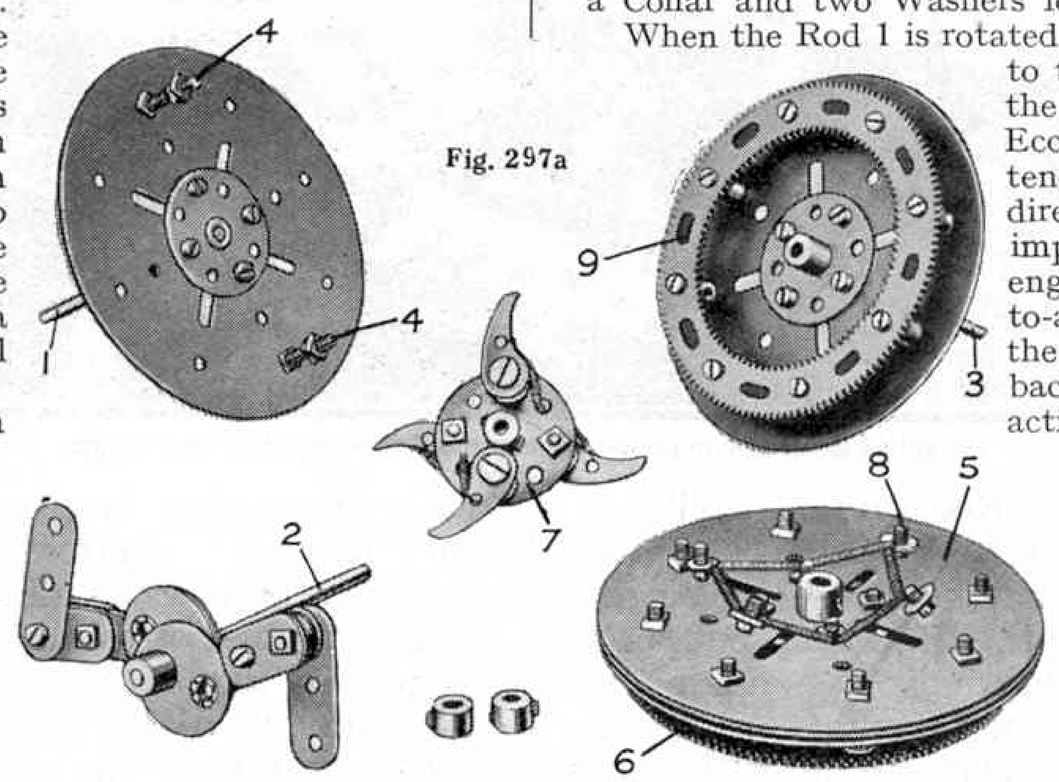


Fig. 297a

The second set of Pawls on the Bush Wheel 7 rotate the Gear Ring 9, thus causing the car to travel forward, the tendency being for the car to free-wheel on the backward stroke until it receives another forward impulse. As the car picks up speed the forward impulses act on the Eccentrics for a longer period, and the reverse impulses are proportionately reduced. Eventually a stage is reached when the Rod 2 rotates uniformly with the driving shaft.

(298)—Engraving Machine (J. R. Hanmer, Birmingham)

By means of the ingenious model shown in Fig. 298 it is possible to engrave name-plates, medallions, etc., of a fairly soft metal such as copper or brass. The model will be found useful for a large number of different purposes, but it will be of greatest utility for engraving names and addresses on articles to prevent loss. The mechanism is mounted on the side plates of a No. E6 Electric Motor. A $\frac{1}{2}$" Pinion on the Motor armature spindle drives a 57-teeth Gear on a secondary shaft carrying a 1" Sprocket Wheel. This drives, through a short length of Chain, a $\frac{3}{4}$" Sprocket on a Rod fitted with a Single Throw Eccentric, the strap of which is passed through an Eye Piece 1 pivoted on a Pivot Bolt passed through one of the Motor side plates. Four Washers are placed on the Pivot Bolt between the Eye Piece and Plate.

As the Eccentric strap moves up and down it strikes the end of the Axle Rod 2, which is filed to a point to form the engraving tool. This Rod is free to slide in a Double Bracket and $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip attached to a framework of Strips bolted to the side plates of the Motor. At its upper end the Rod carries a Collar and Compression Spring, and a second Collar, free to slide on the Rod, is placed below the Spring for spacing purposes. The Rod is prevented from rotating by means of a Flat Bracket 3 fixed to a Collar placed below the Double Angle Strip. The bolt fixing the Bracket carries a Washer under its head, and a second Washer between the Flat Bracket and Collar. A Collar beneath the Double Angle Strip prevents the Rod from being raised to its full extent by the action of the Compression Spring.

When the Motor is set in motion, the Eccentric strap strikes the upper end of the Rod once in each revolution, so that it receives a series of blows in quick succession, and is forced down against the action of the Compression Spring, which returns it to its original position before it is forced down again. The position of the Rod should be so adjusted that its maximum movement is only about 1/16th in. As the Rod is applied to a metal surface the continuous up-and-down movement results in a series of tiny holes appearing in the metal. By holding the device as shown it may be used as a pen for tracing out any kind of lettering or sketching.

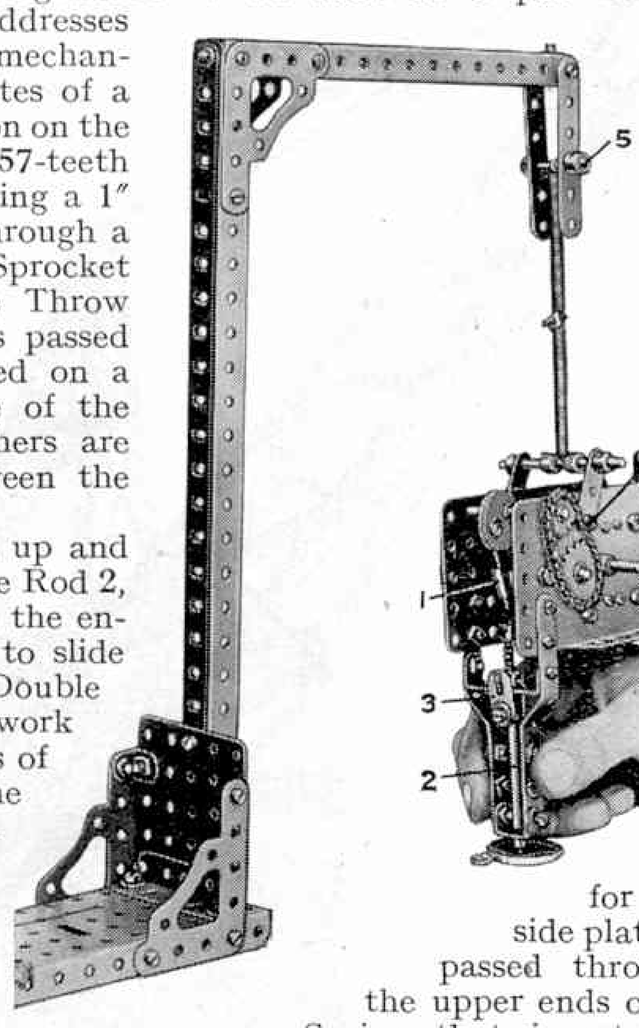


Fig. 298

The weight of the Motor is supported on Springs to facilitate handling. Two $1\frac{1}{2}$" Strips are held in position by the hexagon nuts 4, which are used for holding the Motor side plates together. A Rod passed through the holes at the upper ends of the Strips carries a Spring that is retained in a central position by Collars. A second Spring is bolted to the first, and supported on a Rod 5 passed through a pair of 3" Strips. The position of the Rod may be varied to suit the height of the article being engraved, and the flexibility of the Springs allows free movement of the "pen."

Any convenient support may be arranged for the device, and in the illustration a stand is shown built up from Angle Girders, strengthened by means of Architraves and bolted to a base consisting of a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate. The Plate should be screwed down to the worktable or bench, or it may be weighted to counterbalance the weight of the Motor.

(299)—Level Luffing Gear (A. W. Dickie, Mataura, N.Z.)

A simple form of level luffing gear suitable for model jib cranes of almost any type and size is shown in Fig. 299. The operation of the gear is dependent on the arrangement of the Cord, one continuous length being used for operating both the hoisting and luffing movements. One end of the Cord is tied to the hoisting shaft 1. and is passed under the Rod 2 and over the $\frac{1}{2}$" Pulley 3 to the 1" loose Pulley 4 at the jib head. The Cord then passes round the Pulley in a single sheaved pulley block to which the load hook is attached, and over the second jib head Pulley 5.

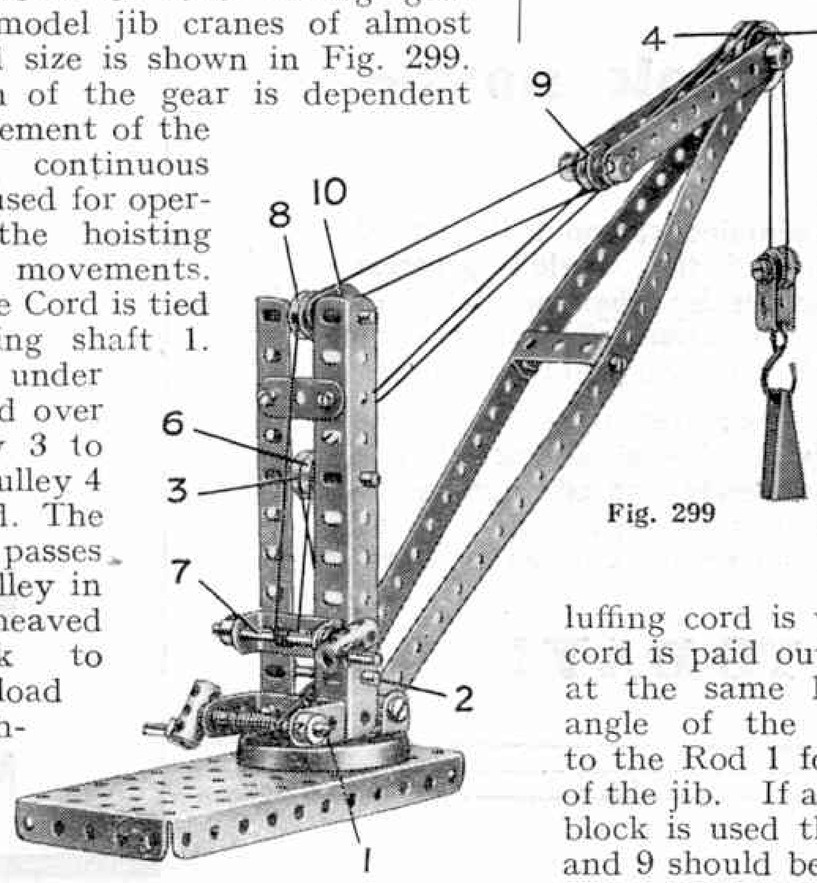


Fig. 299

It is then led over the $\frac{1}{2}$" Pulley 6 and wound several times round the Rod 7, which is fitted with a handle for the operation of the luffing movement. The Cord goes over the Pulley 8, and after passing round the Pulley 9 is tied to the Flat Bracket 10. The $\frac{1}{2}$" Pulley 9 rotates on a 1" Axle Rod carried between the ends of two $4\frac{1}{2}$" Strips pivoted to the jib head.

As the Rod 7 is rotated to raise the jib, the luffing cord is wound in and the hoisting cord is paid out, so that the load remains at the same height irrespective of the angle of the jib. A handle is fitted to the Rod 1 for the raising and lowering of the jib. If a two or three sheave pulley block is used the number of Pulleys at 8 and 9 should be increased proportionately.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

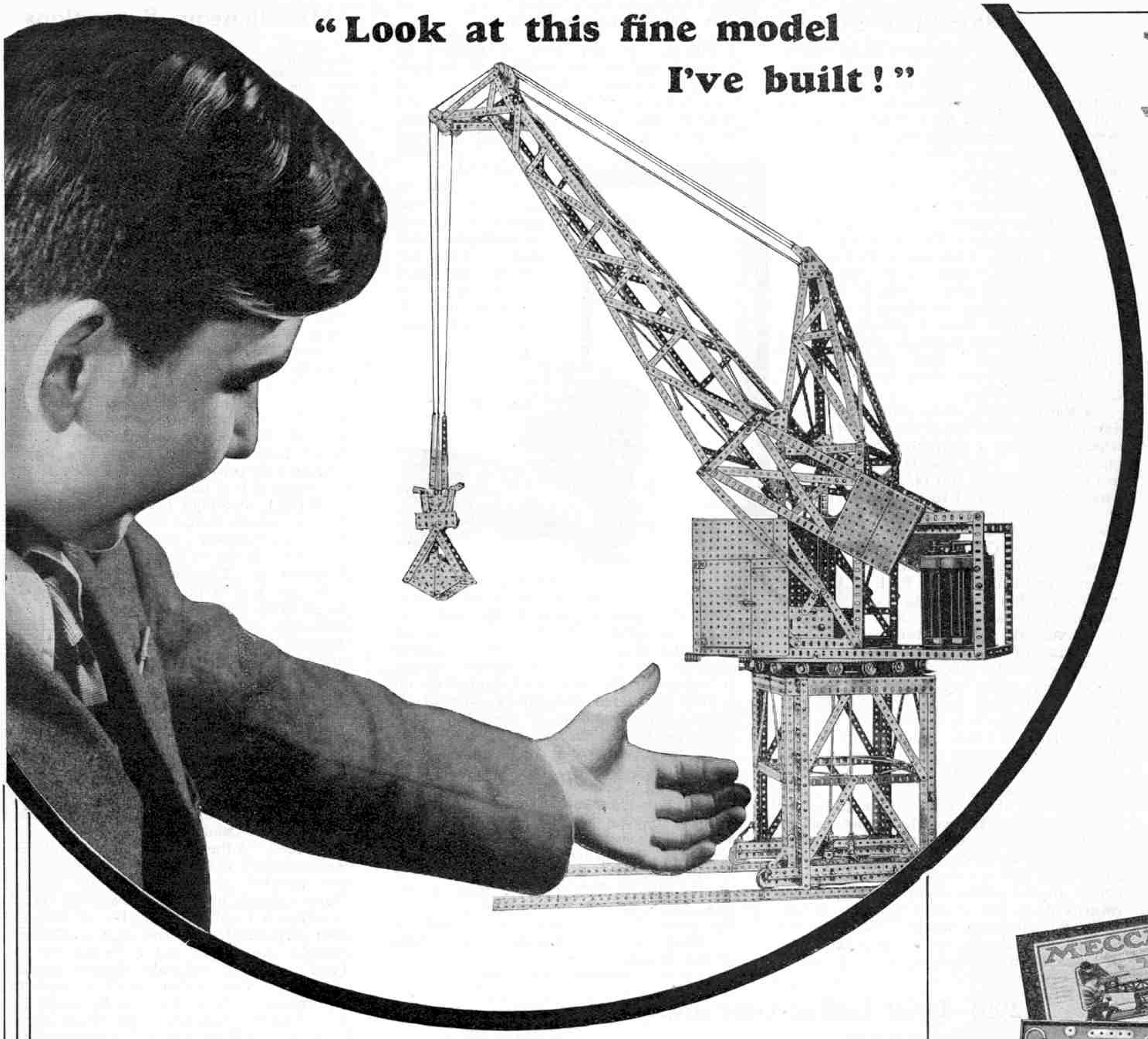
(M.166.) Electro-Magnet for Cranes.—Electro-magnets are sometimes fitted to cranes for raising loads of iron and steel, and a model of one of these magnets has been devised by G. F. Simms (Manningtree, Essex). Two discs 2" in diameter are cut out of stiff cardboard and are punched in the centre to accommodate a $\frac{3}{4}$" Bolt. The discs are spaced apart on the Bolt by winding a strip of paper slightly less than $\frac{1}{2}$" wide on the Bolt shank, the wire afterwards being wound on this to fill in the space between the two discs. A nut holds the discs in position, and the end of the Bolt is inserted in the centre hole of a Boiler End, so that the entire coil fits inside. It will be seen that the head of the bolt forms one pole of the magnet and the rim of the Boiler End the other pole. The Boiler End may be provided with a Pulley Block for fitting it to a model crane.

(M.167.) A Simple Clock Escapement.—A Birmingham reader submits details of a clock escapement mechanism that is extremely simple to construct and is silent in operation. The pendulum is about 3 ft. in length, and is provided with a Double Angle Strip, between the ends of which is stretched a rubber band that passes through the end hole of a $5\frac{1}{2}$" Strip. The rubber band lies parallel to the pendulum, and an extra length of rubber or elastic is tied between the upper end of the Double Angle Strip and the third hole from the end of the $5\frac{1}{2}$" Strip. The other end of the Strip is pivoted to a Bush Wheel driven from the Clockwork Motor. The Bush Wheel should be geared up from the Motor driving shaft, and its speed of rotation is effectively governed by means of the pendulum.

(M.168.) Adjustable Cam.—Several different-shaped cams can be produced by the method suggested by R. Knolls (Birmingham), who employs a Bush Wheel to which a Pawl is rigidly bolted with its boss outermost. As the cam so formed rotates, the tappet rod is raised by the Pawl and drops suddenly when it reaches the end. The speed of the upward movement of the tappet can be varied by adjusting the position of the Pawl in relation to the Bush Wheel. A symmetrical cam can be made by bolting two Pawls in place, one being arranged on each side of the Bush Wheel so that their ends come together. With this construction the tappet rod should be provided with a fairly wide roller for bearing on the cam. For this purpose a Collar may be mounted on a $\frac{3}{8}$" Bolt passing through a small Fork Piece and fitted with lock nuts.

(M.169.) Interrupter for Electrical Models.—An interesting form of "make and break" for use in Meccano shocking coils, etc., has been submitted by R. Mayes (Kyogle, N.S.W.) The device is hand-operated, and consists mainly of a Gear Wheel the teeth of which bear against a Pawl or Strip. As the Gear is rotated and the Pawl moves from one tooth to the next, the electric circuit is completed and broken in rapid succession. An advantage of this arrangement over the magnetic type of contact breaker is that the frequency of the interruptions can be varied at will by changing the size of the Gear or varying its speed of rotation.

"Look at this fine model I've built!"



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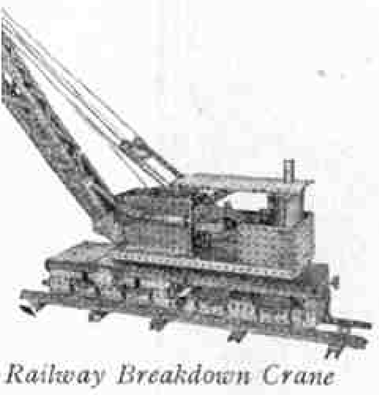
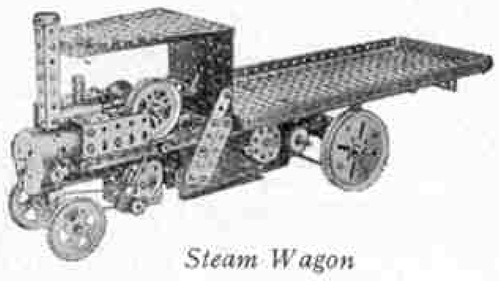
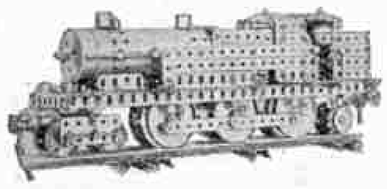


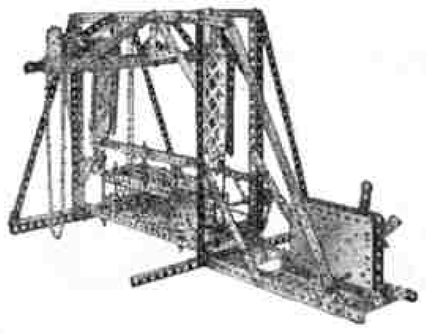
Railway Breakdown Crane



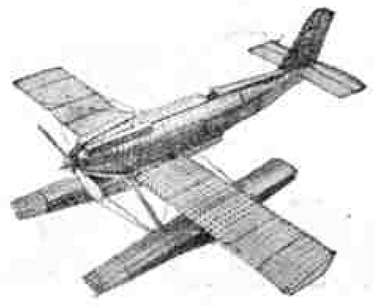
Steam Wagon



Tank Locomotive



Stone Sawing Machine



Racing Seaplane

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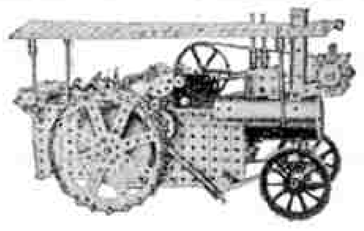
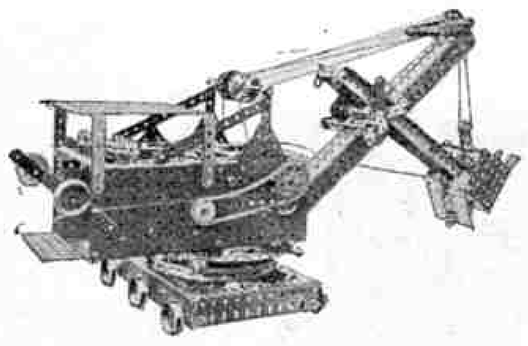
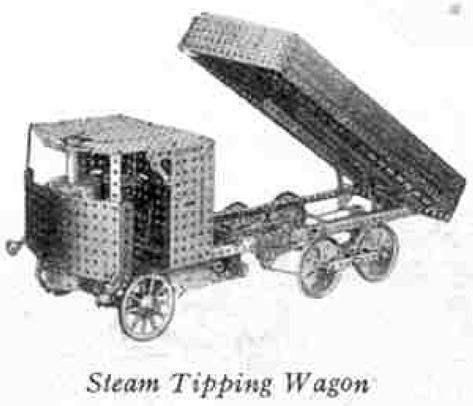


Traction Engine



Steam Shovel



Steam Tipping Wagon

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Outfit				Price
No. X1	Builds	70	models	1/3
No. X2	,,	96	,,	2/–
No. OOO	,,	162	,,	2/6
No. OO	,,	189	,,	3/6
No. O	,,	343	,,	5/–
No. 1	,,	573	,,	10/–
No. 2	,,	629	,,	16/–

Outfit				Price
No. 3	Builds	687	models	27/6
No. 4	,,	753	,,	52/6
No. 5 (Carton)	,,	798	,,	70/–
No. 5 (Cabinet)	,,	798	,,	100/–
No. 6 (Carton)	,,	844	,,	125/–
No. 6 (Cabinet)	,,	844	,,	155/–
No. 7 (,,)	,,	889	,,	415/–

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No. 1 Meccano Outfit

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No. 3 Meccano Outfit

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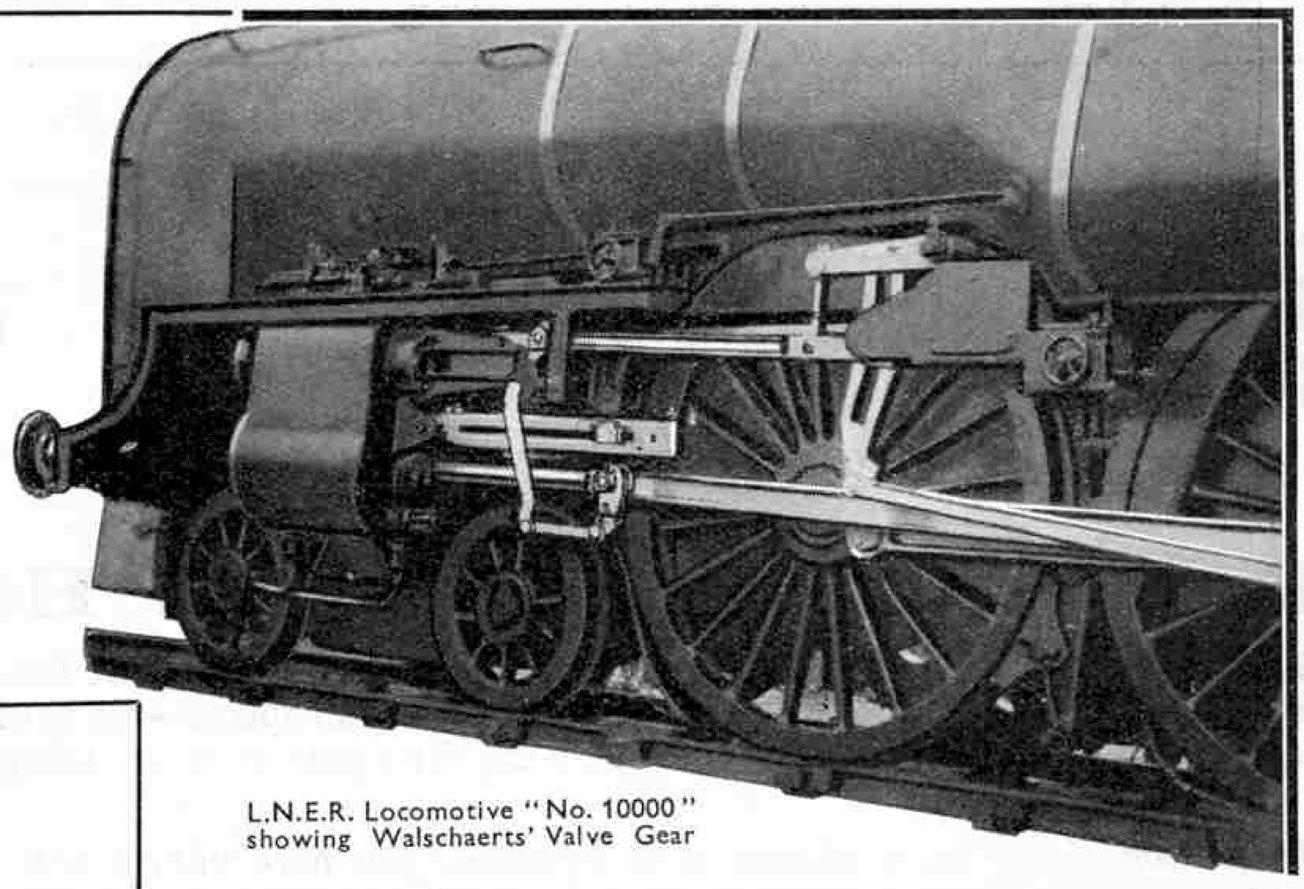
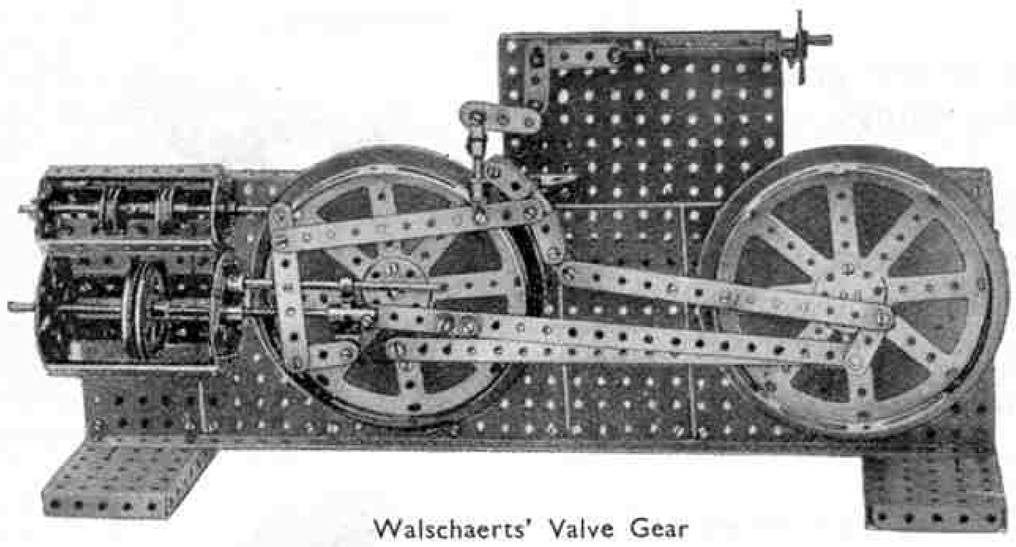
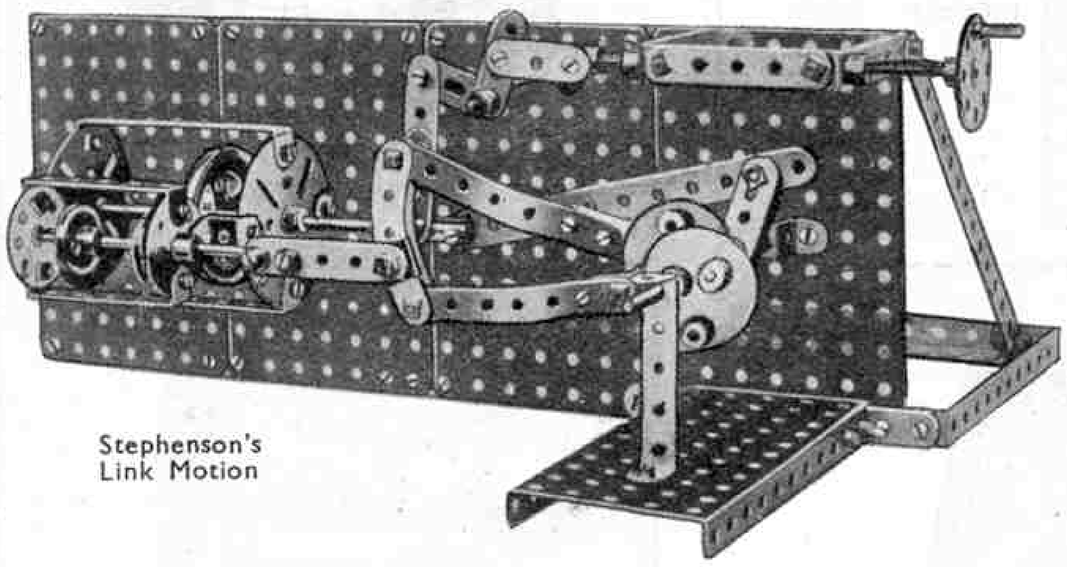
Examples of MECCANO Model Construction



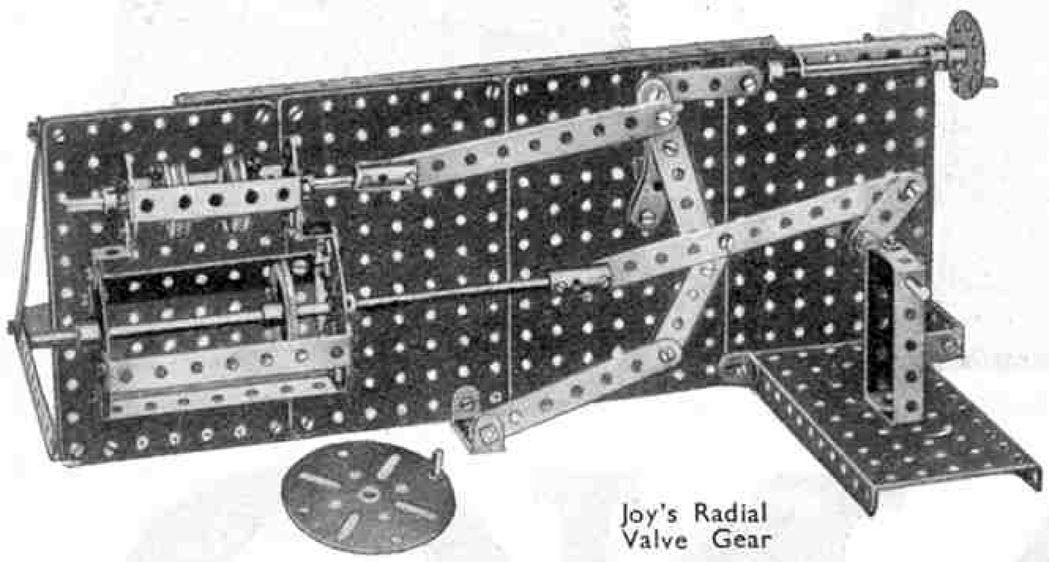
L.N.E.R. Locomotive "No. 10000" showing Walschaerts' Valve Gear



Walschaerts' Valve Gear



Stephenson's Link Motion



Joy's Radial Valve Gear

1. Locomotive Valve Gears

IN spite of all rivals the steam locomotive still exerts its old fascination. Every keen boy is anxious to know how the steam is produced, and how its force is utilised to develop the enormous hauling power and high speed demanded of the locomotive of to-day.

An extremely important part in the working of the locomotive is played by the valve gear that enables the driver to exert complete control of the engine from the lowest speeds to the highest. Various types of valve gear are in use to-day, one of the most popular being the Walschaerts gear shown in the above illustration.

The Walschaerts and other gears are not really complicated mechanisms, but it is not easy to understand their working from a photograph or diagram. All difficulty in this direction is banished completely by the use of Meccano. The Meccano model-builder can construct a complete working model of the mechanism, and by setting his model in motion can follow its action with the greatest ease.

WALSCHAERTS' VALVE GEAR

This gear, of which the Meccano model gives a perfect working demonstration, was invented by Egide Walschaerts, a Belgian engineer, in 1874, and is one of the most popular types in use in modern locomotive practice. The gear is particularly suitable for outside-cylinder locomotives, and it possesses the advantage of giving a constant lead at all points of steam "cut-off."

STEPHENSON'S LINK MOTION

This Meccano model demonstrates the working of the "curved link" valve motion first utilised in 1842 by Robert Stephenson, and still in popular use. In this gear the valve rod takes its motion from a curved link that is rocked by eccentrics mounted on the crankshaft. The link is raised or lowered to bring the valve rod under the influence of either eccentric, giving the engine a backward or forward motion. It is suitable for inside or outside cylinders; and for valves above, below or between the cylinders. This widely employed gear was invented by William Howe, a fitter employed by Stephenson.

JOY'S RADIAL VALVE GEAR

The special advantage of this gear, which was invented in 1879 by David Joy, lies in its extreme simplicity, no eccentrics being used in the mechanism. The gear was employed extensively in locomotives until quite recent times, but has now been largely discarded in favour of valve motions of the Walschaerts type.

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MECCANO

Model-Building Contest Results

By Frank Hornby

"Wagon Tippler" Competition

This competition was arranged in connection with an article dealing with coaling plant that appeared in the April, 1933, issue of the *"M.M."* In this article several types of plant were described, and readers were invited to try their skill in building models of them in Meccano. Although only railway plant was dealt with in the article, competitors were invited to submit models of any other kind of wagon tipping apparatus, such as the rotary machines used at collieries and big railway sidings.

Many of the models sent in are excellently built and equipped to carry out all the movements of the actual machines. One of the best models submitted is shown on this page, and comparison with the prototype on page 264 of the *"M.M."* for April will show how well the features of the original are represented in the model. It was built by J. Willems of Antwerp, and was awarded First Prize in Section C.

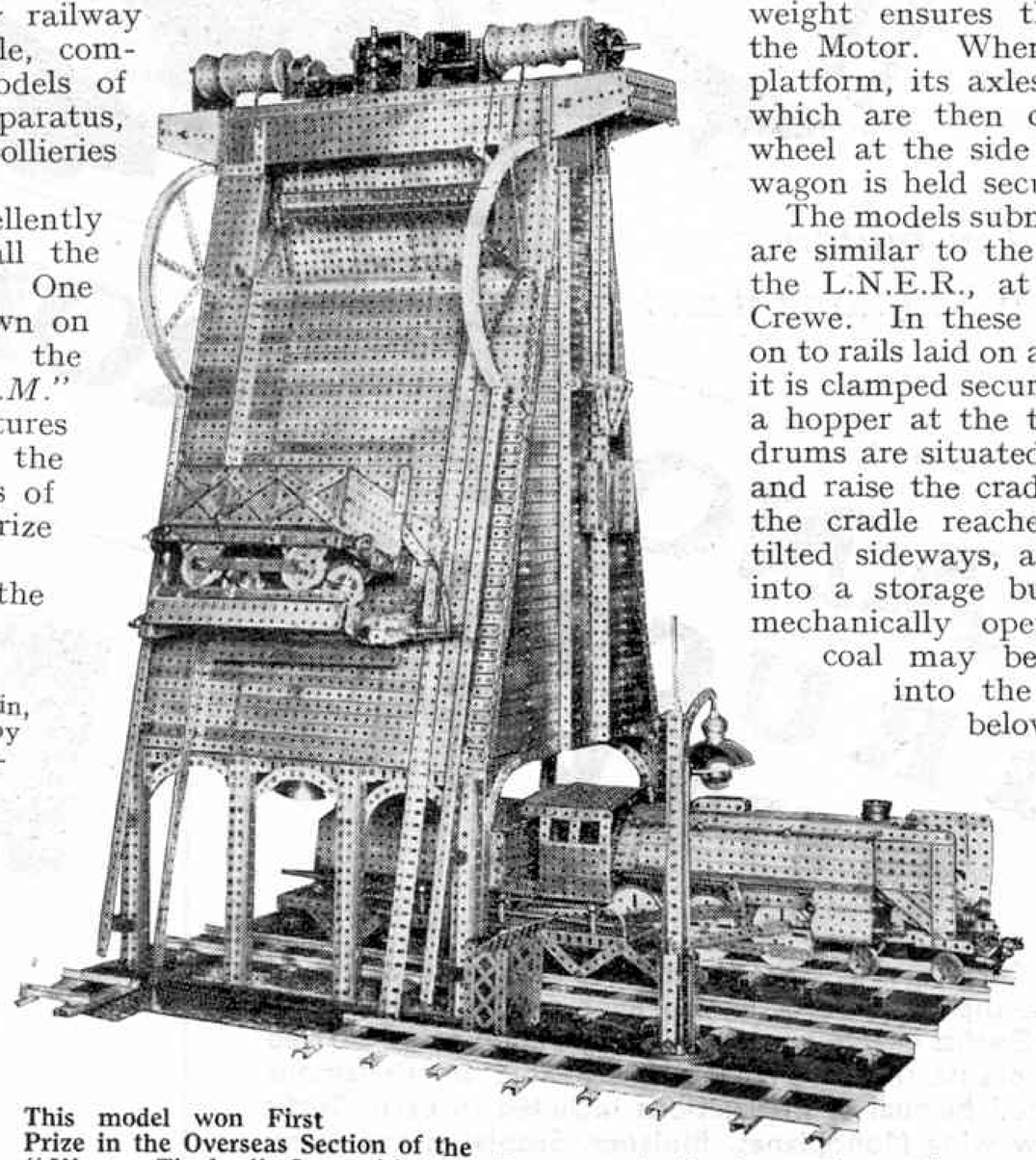
The principal prizewinners in the Contest are as follows :—

Section A (Home competitors of all ages)

First Prize, Cheque for £3-3s.: E. Deakin, Leicester. Second Prize, Meccano or Hornby goods value £2-2s.: F. Coltman, Loughborough Third Prize, goods value £1-1s.: G. S. King, London, S.W.17.

Section B (Overseas competitors of all ages)

First Prize, Cheque for £3-3s., J. Willems, Antwerp, Belgium. Second Prize, Meccano or Hornby goods value £2-2s.: F. Underdown, Greenwich, N.S.W. Third Prize, goods value £1-1s.: B. Hyde, Johannesburg.



This model won First Prize in the Overseas Section of the "Wagon Tippler" Competition. It represents the locomotive coaling plant at Doncaster on the L.N.E.R., and was built by J. Willems, Antwerp.

E. Deakin's model is a copy of one of the rotating cage type tippers in which the wagon is run up inclined rails on to a platform that forms the base of a rotating cage, and is then clamped in position. The end rings of the cage rotate on rollers, which in some machines are driven by hand, and in others by an electric motor. The motion of the rollers is imparted to the cage and the latter slowly rotates and tips the wagon until its contents fall through an opening in the side of the cage and into a hopper.

In Deakin's fine model the cage is rotated by means of Sprocket Chains that pass round Channel Girders and over Sprocket Wheels driven by a Motor. The cage is supported on four 1" Pulley Wheels fitted with Meccano Dunlop Tyres, and a balance weight ensures that an even pull is exerted by the Motor. When the wagon is in position on the platform, its axles are gripped by Double Brackets, which are then clamped in position by turning a wheel at the side of the machine. In this way the wagon is held securely while it is being tipped.

The models submitted by F. Coltman and G. S. King are similar to the locomotive coaling plants used on the L.N.E.R., at Doncaster, and the L.M.S.R., at Crewe. In these machines the loaded wagon is run on to rails laid on an elevator platform or cradle, where it is clamped securely in position and then elevated to a hopper at the top of a high tower. The hoisting drums are situated in a cabin at the top of the tower and raise the cradle by means of wire ropes. When the cradle reaches the hopper it is automatically tilted sideways, and the load of coal is discharged into a storage bunker. The bunker is fitted with mechanically operated doors, through which the coal may be drawn off as required and fed into the tenders of locomotives standing below the discharge chutes. The coaling plant at Doncaster is capable of coaling *"The Flying Scotsman"* in three minutes! Very little power is required to unload a wagon, as both the wagon and cradle are balanced by means of heavy weights moving in guides down the sides of the tower.

In both models the tower, engine house and winding gear have been well reproduced, but I think that the engine house of G. S. King's model is a little out of proportion with the remainder of the structure. This model is driven by means of a Meccano E1 Electric Motor, which is situated at the top of the tower and operates the winding drums through reduction gearing. The controls for the hoisting and lowering operations are placed in a small cabin at the foot of the model.

May "Simplicity" Competition

The principal prizewinners in the May "Simplicity" Model-Building Contest are as follows :—

Section A (Competitors over 14)

First Prize, Cheque for £3-3s.: T. Green, Mapperley. Second Prize, Meccano or Hornby goods value £2-2s.: T. Tasker, Barnsley. Third Prize, Goods value £1-1s.: W. Wilbur, Watford.

Ten Prizes of Goods value 5/–: W. Essery, Newport; P. Parish, Rugby; H. Elderfield, London, E.2; J. Mathieson, London, W.8; F. Robey, Derby; C. L. Rippon, Coventry; A. Mallock, Wimborne; A. Hampson, Widnes; M. Tweedie, Tilehurst; A. Gravely, Wellingborough.

Ten Prizes of "*Famous Trains*": D. Grist, London, S.W.16; B. Simpson, London, S.W.5; W. Whitaker, Hornsea; C. Wrayford, Moretonhampstead; J. Trevethan, Bere Ferrers; G. Odgers, Norwich; F. Burgess, Birmingham; B. Crozier, Grays; G. A. Dean, Newcastle-on-Tyne; H. Dicken, Wrexham.

Section B (Competitors under 14)

First Prize, Cheque for £2-2s.: K. Pharaoh, London, N.13. Second Prize, Meccano or Hornby goods value £1-1s.: J. Jones, Manchester 14. Third Prize, Goods value 10/6: W. Cawthra, Bradford.

Ten Prizes of Goods value 5/–: G. Cotton, Niton, I.O.W.; J. Thorp, Grantham; L. Hollings, Calverley; R. George, Brighton; J. Gabbuh, Mellor; R. Rowley, Bromley; A. Rushton, Berkhamsted; G. Knapman, Woodford Green; T. Lonie, March; P. Wiggs, London, S.E.24.

Section C (Overseas competitors of all ages)

First Prize, Cheque for £3-3s.: G. Christos, Johannesburg. Second Prize, Meccano or Hornby goods value £2-2s.: T. Buddle, Auckland. Third Prize, Goods value £1-1s.: L. Kilgour, Oamaru, N.Z.

Ten Prizes of goods value 5/–: J. Cesak, Winnipeg; P. Macdonald, Coe Hill, Ontario; H. Baker, Plunkett, Sask.; J. Noble, Wellington, N.Z.; C. Reade, Taumarunui, N.Z.; G. Clarke, Gisborne, N.Z.; H. Mountfort, Ohakune, N.Z.; R. Cain, Durban; A. Arnold, Melbourne; C. Boeke, Baarn, Holland.

Ten Prizes of "*Famous Trains*": B. Choksi, Karachi; A. Boeke, Baarn, Holland; C. Tomblin, Johannesburg; C. Blackbeard, Johannesburg; A. Ness, Port Dalhousie, Ontario; R. Lindsay, Winton, N.Z.; L. Boyer, Invercargill, N.Z.; N. Burt, Nelson, N.Z.; S. Kendall, Auckland, N.Z.; L. Puckridge, Lake Wangay, S. Australia.

"Small Outfits" Contest

The principal awards in this Competition are as follows :—

Section A (Home competitors under 16)

First Prize, Cheque for £2-2s.: N. Reed, Letchworth. Second Prize, Meccano or Hornby goods value £1-1s.: A. Ruston, Berkhamsted. Third Prize, goods value 10/6: G. Cole, Camberley, Surrey.

Five Prizes of Meccano or Hornby goods value 5/–: D. MacGowan, Dublin; M. Wild, Leeds 10; P. Addiscott, Gillingham; V. Chambers, Rugby; P. Howard-Flanders, Letchworth.

Section B (competitors under 16 living Overseas)

First Prize, Cheque for £2-2s.: L. King, Sydney. Second Prize, Meccano or Hornby goods value £1-1s.: D. Nelson, Masterton, N.Z. Third Prize, goods value 10/6: G. Swain, Waikato, N.Z.

Five Prizes of Meccano or Hornby goods value 5/–: M. Thomas, Udamalpet, S. India; T. Huygen, Amersfoort, Holland; L. Boyer, Invercargill, N.Z.; D. Hill, Nelson, N.Z.; J. Lambeth, Wollongong, N.S.W.

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Boys, Meccano Aeroplane Outfits are great! They enable you to build wonderful models of aeroplanes—the most realistic you ever saw.

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Magnificent models of high and low wing monoplanes, and interesting model biplanes representing standard types can be built with this fine Outfit. Price 9/–

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This is the finest and most attractive Aeroplane Constructor Outfit on the market. It contains a big range of aircraft parts, with which numerous models of practically any type of machine may be built—44 examples are shown in the Manual of Instructions. All the parts that are special features of the No. 1 Special Outfit are included, also a number of other parts of special design. Price 25/–

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MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

No. O Aeroplane Constructor Outfit

No. 1 Special Aeroplane Outfit

No. 2 Special Aeroplane Outfit

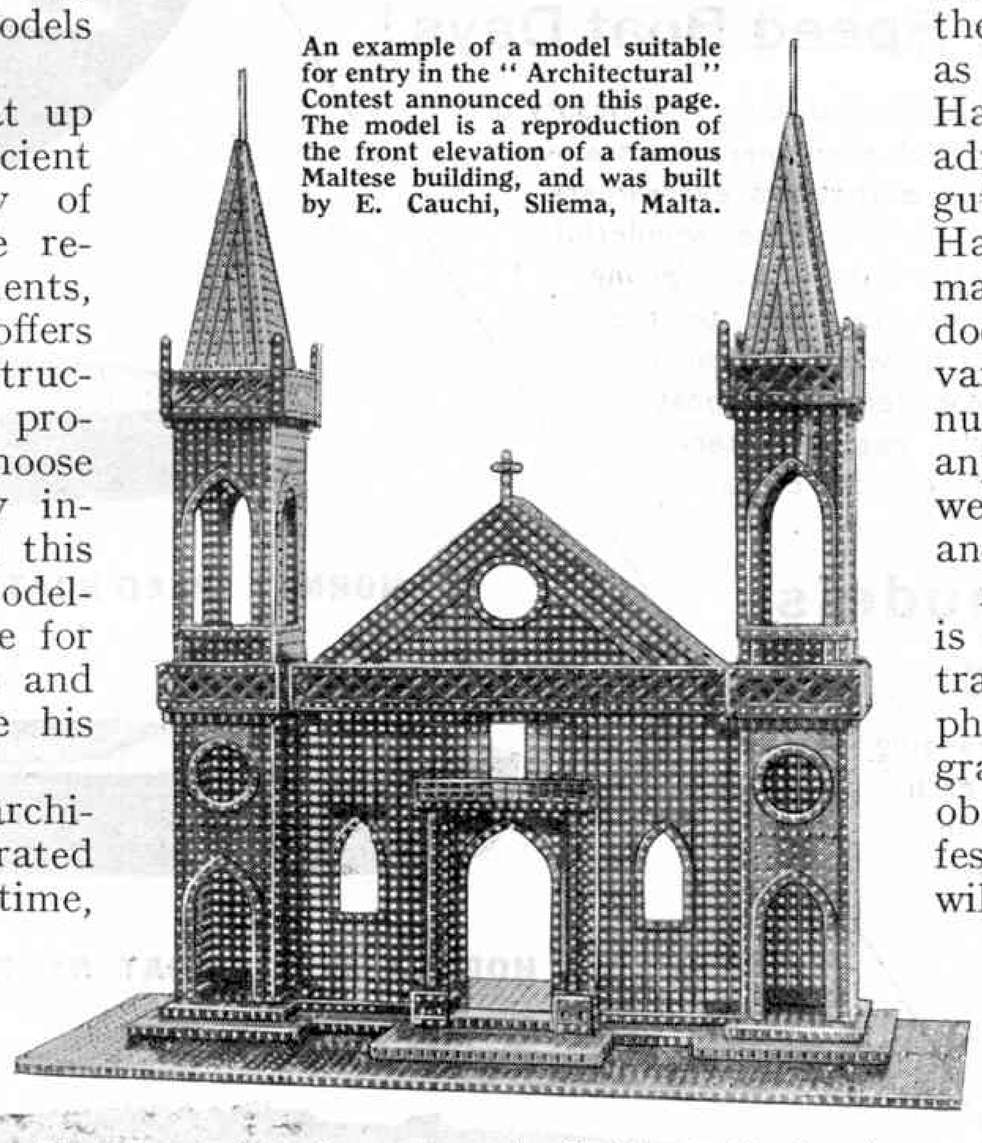
"Architectural" Model-Building Contest

Prizes for Model Buildings, Monuments, Castles, etc.

A FEW months ago we arranged a novel competition in which the competitors were asked to submit Meccano models of houses, castles, monuments, or other architectural structures. The competition proved a great success, and we have decided to give readers another opportunity to exercise their skill in building models of this kind.

Architecture is a subject that up to now has not received sufficient attention from the majority of Meccano model-builders. The reproduction of castles, monuments, churches and similar structures offers a welcome change from the construction of mechanical models, and provided that care is taken to choose suitable Meccano parts, really interesting work can be done in this direction. Architectural model-building also gives ample scope for originality in choice of subject and for the competitor to exercise his artistic abilities.

Several fine examples of architectural models have been illustrated in the "*M.M.*" from time to time, and a special article dealing with this branch of model-building was included in the "*M.M.*" for September, 1931. The illustration on this page shows another example of the splendid work that can be done in this line.



An example of a model suitable for entry in the "Architectural" Contest announced on this page. The model is a reproduction of the front elevation of a famous Maltese building, and was built by E. Cauchi, Sliema, Malta.

In the present Contest we are offering a big range of prizes for the best constructed architectural models of any kind sent in by readers. The prizes will be awarded for originality of subject, neatness of construction, and realism of the completed model. The judges will also look for good proportions and rigid construction. Any architectural structure may be chosen for modelling, but if possible one of the well-known buildings, monuments or castles should be selected.

Illustrations of suitable subjects are quite easy to obtain, and photographs of many fine buildings that would be excellent for reproduction have been published in the "*Meccano Magazine*." The actual choice should be determined by the size of Outfit available. If only a small Outfit is used, the wisest selection will be a simple church, or a small building such as a modern villa or a club house of the kind seen on golf courses and cricket grounds.

When the subject has been decided upon, the next step is to construct the model. Any size of Outfit may be used, and simple models built from small Outfits will receive just the same consideration as large models. Mere size alone will not ensure success for a model. Some of the Meccano parts are specially suited to architectural work, and these should be made use of as much as possible. For example, Crank Handles (Part Nos. 19 and 19s) make admirable downcomer pipes for the gutters of a model house, and the Handrail Support (Part No. 136) may be used with great effect as a door handle. Careful study of the various parts will soon reveal a number of novel uses for them, and any time given to this point will be well rewarded by the realistic appearance of the finished model.

After the model is completed it is only necessary to obtain an illustration of it. This may be either a photograph or drawing, but a photograph is best if it is possible to obtain one. This need not be a professional photograph, a small "snap" will do provided that it is clear and sharp in detail.

In order to give every competitor an equal chance the Contest is divided into Sections as follows—Section A, for models built entirely from Outfits not larger than No. 3; Section B, for models built from Outfits Nos. 4, 5, 6 and 7. Each Section is open to competitors of all ages living in any part of the world, and each competitor must indicate the Section for which his model is eligible by writing a large letter A or B on the back of each photograph or drawing submitted. The competitor must also state his age, name and address, and if the model is a large and complicated one a short description of its construction should be prepared. This, together with the photograph or drawing, should be enclosed in an envelope addressed Second "Architectural" Competition, Meccano Ltd., Binns Road, Liverpool 13.

A full list of prizes to be awarded in each Section is announced in the panel at the foot of this page. Both Sections A and B will close for entries on 28th February, 1934.

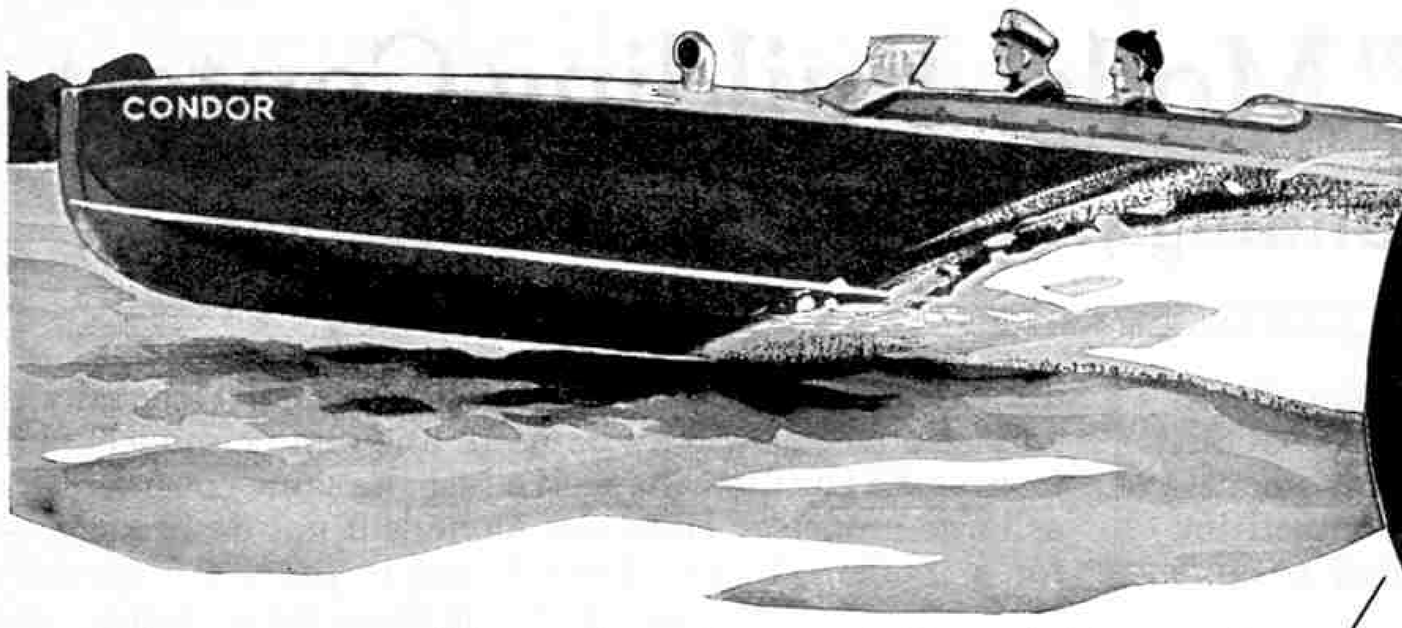
All photographs or drawings of prizewinning models become the property of Meccano Ltd., but unsuccessful entries will be returned provided that a stamped envelope is enclosed.

"Architectural" Contest

LIST OF PRIZES

Section A (open to Home and Overseas competitors).
First Prize, Meccano or Hornby Goods value £2-2s.
Second Prize, No. 3 Kemex Outfit, value £1-5s.
Third Prize, No. 2 Kemex Outfit, value 15/-.
Five Prizes of No. 1 "Kemex" Outfits, each value 7/6.
Ten Prizes of "How to Use Meccano Parts" Manuals.
Certificates of Merit.

Section B (open to Home and Overseas competitors).
First Prize, Meccano or Hornby Goods, value £3-3s.
Second Prize, Meccano or Hornby Goods, value £2-2s.
Third Prize, No. 2 Elektron Outfit, value £1-5s.
Ten Prizes of No. 1 "Elektron" Outfits, each value 8/6.
Ten Prizes of Meccano or Hornby goods, each value 5/-.
Engineer's Pocket Books and Certificates of Merit.
(Winners of "Kemex" or "Elektron" Outfits may have other Meccano or Hornby goods if preferred.)



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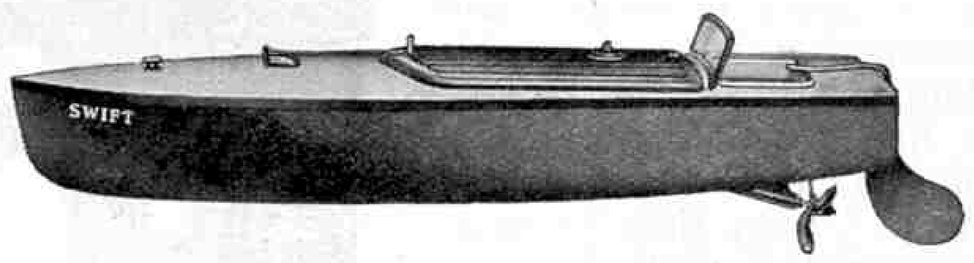

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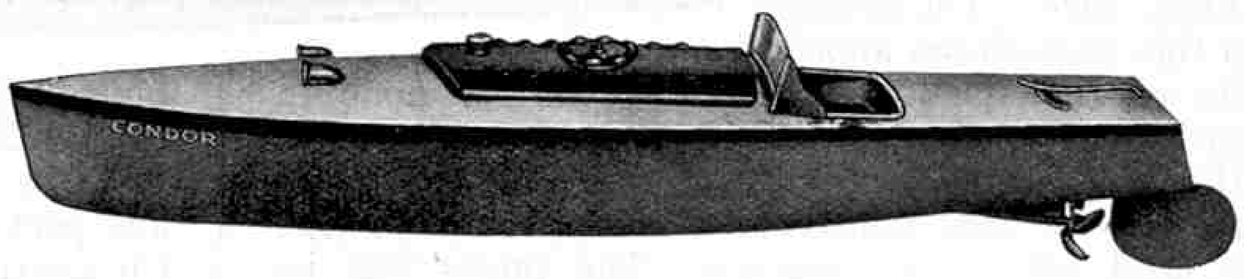

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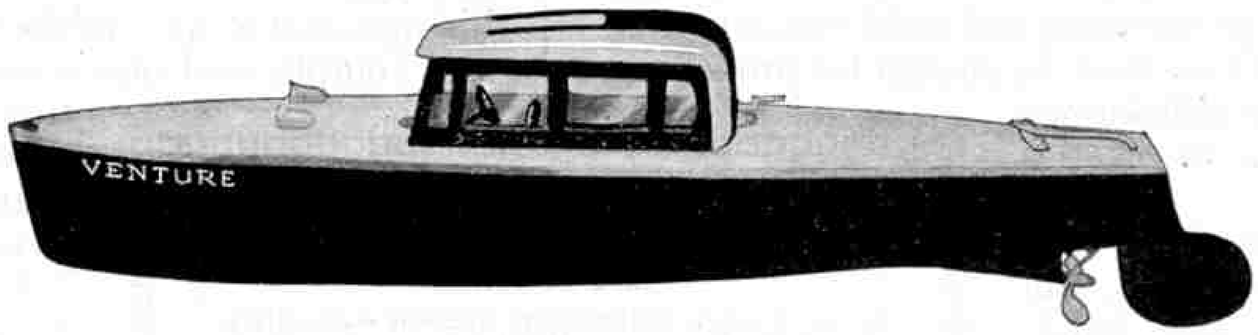

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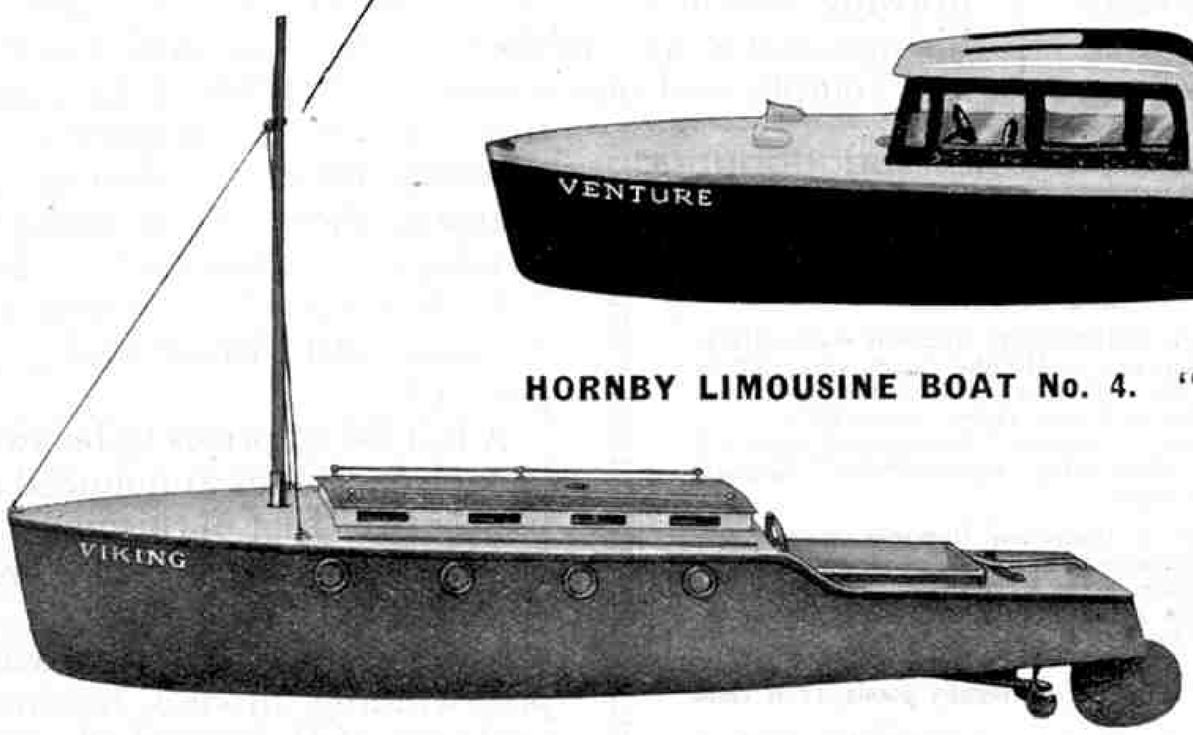

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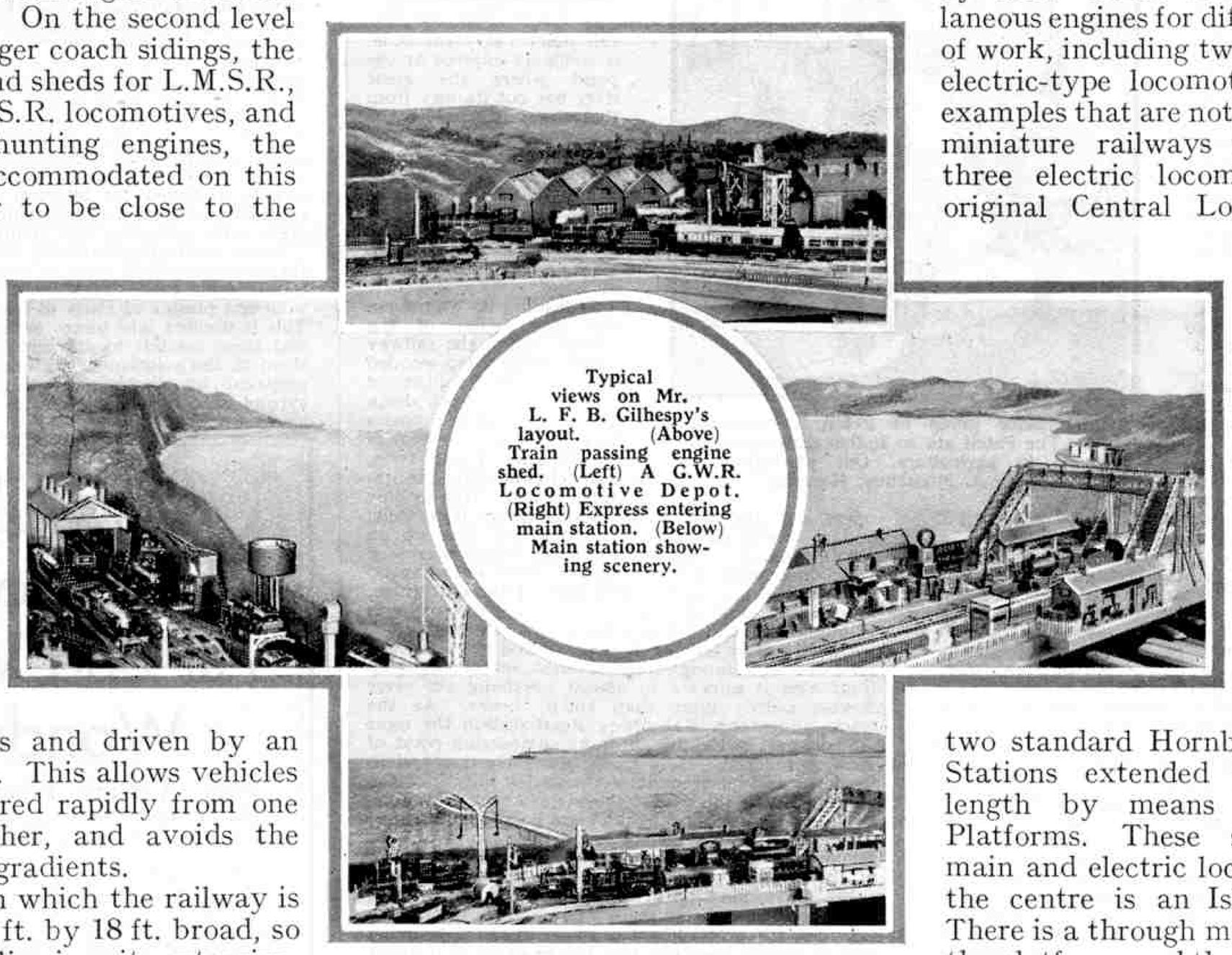
MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

An Interesting Miniature Railway

Mr. L. F. B. Gilhespy's Layout

THE miniature railway system illustrated on this page is owned and operated by Mr. L. F. B. Gilhespy of Birmingham. The layout is remarkable in several respects. It has three separate levels; the locomotives and rolling stock of all groups are represented; and the lineside scenery is very realistic, and is complete even down to a miniature scrap heap composed of locomotives and coaches, wheels, and odd parts!

Of the three levels, the uppermost one accommodates the main line with engine sheds for G.W.R. stock. On the second level are the passenger coach sidings, the goods yards and sheds for L.M.S.R., L.N.E.R. and S.R. locomotives, and for all the shunting engines, the latter being accommodated on this level in order to be close to the goods yard. The third level is chiefly for storage purposes, mostly of goods wagons that are not in use. All three levels are served by a special lift constructed of Meccano parts and driven by an electric motor. This allows vehicles to be transferred rapidly from one level to another, and avoids the necessity for gradients.



Typical views on Mr. L. F. B. Gilhespy's layout. (Above) Train passing engine shed. (Left) A G.W.R. Locomotive Depot. (Right) Express entering main station. (Below) Main station showing scenery.

The room in which the railway is installed is 20 ft. by 18 ft. broad, so that the main line is quite extensive. Actually it is arranged on the continuous plan, and is provided with three or four tracks throughout. The outermost through track is 51 ft. long, and its inner counterpart 47 ft. long; and there is a 40 ft. loop line and a complete electric circuit with a length of 45 ft.

Express passenger and goods trains are dealt with by clockwork engines of various types, local goods and suburban traffic being electrically operated. Altogether some 62 locomotives are in use, and the passenger and goods vehicles total about 100. Foremost among the passenger locomotives are 12 Hornby G.W.R. No. 2 Specials, an interesting point about which is that 11 have been renamed after various "Counties" of actual practice, and renumbered to avoid confusion with the standard "*County of Bedford.*"

Similar renumbering has been carried out with other locomotives, an old Hornby G.W.R. No. 2 Tender Engine being No. 3417, "*Lord Mildmay of Flete,*" thus representing the useful small-wheeled 4–4–0s of the "Bulldog" class. Another 4–4–0 is named "*City of Birmingham,*" a very suitable title in view of the situation of the line; and a 3C Locomotive renamed "*La France*" recalls the three famous De Glehn "Atlantics" once possessed by the G.W.R.

Each group company is represented by Hornby No. 2 Special Tender Locomotives, so that "Counties," "Shires," "Compounds" and "L1" engines work side by side. There are other miscellaneous engines for different varieties of work, including two Metropolitan electric-type locomotives. Among examples that are not often found on miniature railways of to-day are three electric locomotives of the original Central London "tube" type, and a model of one of the former Midland Railway "999" class 4–4–0s, once well known but now all withdrawn.

The main station consists of two standard Hornby "Windsor" Stations extended to a suitable length by means of Passenger Platforms. These serve the up main and electric local lines, but in the centre is an Island Platform. There is a through main line clear of the platform, and there are two local bay platforms. On the opposite side of the layout to this station is a large tunnel through which pass three tracks, the up and down main, and the electric local that serves a small wayside station adjacent to one end of the tunnel.

The scenic background provided is remarkably realistic, as may be judged from the accompanying illustrations. In the section shown in the upper photograph the background consists partly of a small township, and close by the line is a building arranged as an engineering works. This is situated conveniently near a locomotive depot, and a model overhead gantry travelling crane is provided for lifting locomotives for repair. In the left of this photograph it will be noticed that the general tendency of the country is gradually upward. This rise is developed for some distance, and the succeeding length of scenery is based on the wild characteristics of Dartmoor.

The left-hand photograph shows another engine yard. The shed is placed in a picturesque (Continued on page 928)

Famous Admirals—(*Continued from page 841*)

This continued for six hours, and during that time as many as 1,500 cannon balls were fired, and the Spanish defenders at the head of the mole were driven from their guns.

Rooke then ordered one of his officers to storm the mole. The first of the armed seamen to spring ashore were checked by the explosion of a mine under the Spanish fortification, two officers and 40 seamen being killed and many others wounded. The prompt arrival of the remainder of the storming force resulted in the capture of the mole, however, and when Rooke again demanded the surrender of Gibraltar, the Governor had no alternative but to march out with the remainder of the garrison. The English losses in this victorious attack, which placed in their hands the key of the Mediterranean, were two officers and 58 men killed, and three officers and 208 men wounded.

After capturing Gibraltar, Rooke returned to Tetuan to replenish the provisions of his fleet, and returning on 9th August, sighted a French fleet. The French fled towards Velex Malaga, a town 14 miles north east of Malaga, and when Rooke came up with them after delaying to summon 900 marines from Gibraltar he discovered that they had been considerably reinforced. They did not stay their flight until next morning, when they halted and prepared to fight. The French fleet included 52 sail of the line, 24 galleons and numerous fireships and smaller craft. It was manned by 25,000 seamen and carried 3,681 guns, and was under the chief command of Admiral de Toulouse, High Admiral of France. There were 53 sail of the line and six smaller vessels in the English fleet, which mounted 2,940 guns and was supported by 12 Dutch ships under the command of Admiral Calembourg.

Accounts of the fierce battle fought on 13th August differ much in detail. At the beginning the English van, led by Shovel, was so far ahead of the centre that the French would have succeeded in isolating and surrounding it had not Rooke observed the danger in time to hurry forward to his subordinate's help. During the fight many of the English ships ran short of ammunition, owing to their heavy expenditure of shot during the capture of Gibraltar, and their lack eventually caused them to withdraw from the action. After four hours of intense fighting, the French van began to give way before the English, and shortly afterward the French rear gave way to the Dutch, but the approach of darkness ended the fight, with neither side having captured a single ship. The English lost nearly 700 men killed and over 200 wounded, and the French losses were as great.

The following day was spent in repairing ships and attending to the wounded, and during the second night the French fleet escaped to Toulon. Rooke then returned to Gibraltar, where he refitted before sailing for for Portsmouth, leaving a squadron to protect Gibraltar.

On 29th September, 1704, a few days after his arrival back in this country, he was presented to Queen Anne and Prince George at Windsor. Apart from this instance, however, Rooke did not have a very cordial reception, for the indecisive results of the battle of Velez Malaga had given rise to dissatisfaction, and he retired from active service in 1705. He did not live long to enjoy his well-earned retirement, for he died on 24th January, 1709.

A picturesque group of Patels in ceremonial dress. The Patels are an Indian caste, generally occupied in agriculture. Our photograph is by I. A. Moosbhoy, Karachi.

Fighting Famine in India—(*Cont. from page 843*)

77,000 men to dig the extensive canals required.

The flow of water from the main canals to the distributing channels is carefully controlled by means of regulators provided with several gates that can be opened separately. No fewer than 350 of these gates are required; all have spans of 10 ft., and their depths vary from 5 ft. to 12 ft. 6 in. The gates were built in sections in order that they could be erected easily. They are operated manually, and each can be opened or closed with ease by two men.

Digging these canals in the desert was a trying task. Sind is subject to strong winds and frequent sandstorms, and dumping the buckets in these conditions meant that men and machines were working in a cloud of dust and sand. This caused such excessive wear on all exposed working parts that it was found necessary to enclose the draglines, and to provide specia protection for the Diesel engines by which the machines were operated.

In addition to food for the men, all necessary supplies, such as fuel oil and water, had to be transported to the machines by camel transport across miles of desert and uninhabited country. For the most part the operators lived in tents, close to their machines, repitching their camp every week as the machines moved on. Their drinking water was not improved by a long journey in petrol tins on the backs of camels, and it was found exceedingly difficult to supply these far-scattered camps with fresh meat and vegetables.

Just as work was continued day and night on the great retaining wall across the Indus, so the draglines were operated on a three-shift basis, night and day, summer and winter. So well organised was the whole undertaking that the Barrage was officially opened on 13th January, 1932, nearly a year before the scheduled time. Thus has the engineer conquered the great Sind desert and won another victory in India in his efforts to combat the famine scourge.

Indian Mountain Line

(*Continued from page 861*)

this point 750 yards wide, is suddenly entered at the point where the great river has cut its way from the mountain tract to the plains through a deep and narrow gorge. On passing through the Sevoke Gorge the traveller at once finds himself enclosed by steep mountains clothed in dense forest, with the great river flowing close at hand.

Threading its way along the steep sides of the narrow valley the railway circles round deep wooded bays in the depths of which torrents rush down to the river below; passes through shady groves of overhanging forest trees, and circumvents precipitous rocks. The valley opens out and higher mountains come into view, and a double-eight curve carries the line up to Riyang station. The River Riyang, which is crossed here, once came down in mighty flood and changed its course in one night. The piers of the old bridge, marking the original course of the river, may be seen standing high and dry in a wilderness of stones.

Shortly after leaving Riyang station the line runs for half a mile through tropical forest, and on emerging from this it appears to almost overhang the river flowing swiftly more than 100 ft. below. As the track approaches Kalimpong Road station the most difficult part of the line, from an engineering point of view, is reached. Here much heavy blasting had to be done, and on account of the shaley nature of the mountain sides this caused the engineers much trouble. The line terminates near the Teesta Suspension Bridge, and a good road enables the traveller to cover the remaining two miles from Kalimpong Road station to the bridge, a fine structure high above the river.

We have mentioned that this branch line was built largely on an old road. The line runs alongside the road for practically the whole distance, crossing and recrossing from one side to the other of it every few hundred yards during the long climb. On account of these numerous crossings, and the many blind corners on the route, this is divided into sections, and there is a system of permits for motor drivers by which they are informed of the presence of all trains and cars in each section before going forward.

For the information contained in this article, and also for the illustrations, we are indebted to the courtesy of the Darjeeling Himalayan Railway Co. Ltd.

What Shall I Be?—(*Continued from page 849*)

whenever possible attendance on a third evening is advised. The intermediate examination demands a knowledge of the methods used in photo-engraving reproduction, in addition to elementary physics and chemistry related to the work. Candidates are required also to have a detailed knowledge of either line-block making, half-tone block making, photogravure, photo-lithography, or three-colour half-tone block making. During the final course of two years the student is given wider and more advanced instruction in all branches of the subject. At the final examination he is required to take two written question papers, each of three hours' duration, and also to sit for a practical examination of three hours' duration on each of two evenings. The practical examination is in two of the five branches just mentioned in connection with the intermediate examination.

Boys who live in or near London have at their disposal an important school that is devoted entirely to photo-engraving, the School of Photo-Engraving and Lithography, 6, Bolt Court, Fleet Street, London, E.C.4, which was referred to earlier in this article. This school holds classes in process-engraving and art, both during the day and in the evening. The fee for full-time instruction at the day classes in either process-engraving or commercial art is £15 per session, and the usual cost of evening classes in any subject is £1 per session. Students not directly engaged in the trade, but who are otherwise eligible for admission, are sometimes allowed to join the classes, but they are charged twice the normal fee.

Chemical Magic at Home—(*Cont. from page 867*)

colour. The change proceeds in the ordinary way for a day or two, and then a remarkable change occurs, for the band comes to an end and a second layer of lead chromate begins to form, a gap being left between it and the first one. As the experiment is continued, many bands of this kind form in the tube, in the manner shown in Fig. 4, which shows how the layers of precipitate are formed at successively greater intervals. Traces of this peculiar band formation, which is usually described as rhythmic precipitation, can often be seen in other cases of precipitation following diffusion into jelly prepared in this manner.

To most experimenters, the formation of chemical gardens in solutions of water glass, illustrated in Figs. 2 and 3, is the most interesting case of precipitation. The full instructions given in the Kemex Manuals will enable owners of Outfits to carry out these experiments successfully, and those who wish to extend their results can try other chemicals that form insoluble silicates, and also use solutions containing a greater proportion of water glass in order to obtain larger growths. Care should always be taken to use freshly-made solution, and it is best to use water that has been boiled when preparing the liquid. In spite of these precautions, the solution occasionally is slightly milky, owing to the precipitation in it of silica by carbon dioxide from the air, or from the water, but this can be removed by filtering. The lid of the tin containing the water glass should be replaced immediately after removing the quantity required.

As an interesting variation of this experiment, the chemicals employed may be crushed to powder, and mixed into a paste with a few drops of water and just sufficient plaster of Paris to make a good stiff mass. This is divided into pieces about the size of a bean, and these are left to dry and harden before placing them in the solution of water glass, which should be prepared by dissolving two tablespoonfuls of the syrupy fluid in a tumblerful of water.

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The Book of Air and Water Wonders

With Colour Frontispiece, 32 Half-tone Illustrations and some Line Drawings.

Mr. Ellison Hawks, in his usual fascinating way, describes the composition, extent, pressure, and temperature of the atmosphere; dew, mist, and fog; seasons, climate and winds; storms of various types; glaciers and icebergs; waterfalls and lakes, etc.

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HARRAP

INTERNAL GEARING

In response to a widespread demand from model-builders, an internally-toothed gear has been added to the range of Meccano Parts. The new part, No. 180, Gear Ring, resembles a Circular Strip of 2½" inside diameter and 3½" outside diameter, with 95 teeth cut in the inner edge and 133 teeth round the outer rim. The part is provided with 16 perforations, as will be seen in the illustration in the panel on this page, and the arrangement of these holes is such that allowance is made for adjusting and centring the part by means of slots.

The applications of this part will at once be apparent to advanced model-builders, but a few notes on its various uses will be useful to those less experienced. The chief uses will be found in the construction of epicyclic gear boxes, and an entirely new field for experiment is opened up in this direction. A 57-teeth Gear forming the "sun wheel" can be arranged to mesh with ½" Pinions serving as "planet wheels," and engaging the inside set of teeth of the Gear Ring. The Pinions may be mounted on ¾" bolts each fixed by two nuts to a 3½" Strip or 4" Circular Plate, which is free on the Rod carrying the 57-teeth Gear. If a Strip is used for this purpose, a Double Arm Crank should be bolted over the centre hole. A Socket Coupling fitted to the Boss of the Double Arm Crank or Face Plate may be provided with a Gear or Pinion for driving purposes.

The Gear Ring may be mounted on a 4" Circular Plate fitted on an independent Rod, in which case there are three rotating units, namely, the Gear Ring, the "sun wheel," and the frame carrying the "planet pinions," any one of which can be stopped while the other two are connected to driving and driven shafts. A wide variation of speed can be obtained by driving through the 57-teeth Gear and the Face Plate carrying the Pinions, and also driving the Gear Ring by means of the external set of teeth. The speed of the driven shaft will then be varied according to the variation in the speed of the Gear Ring.

The new part may be utilised also where a small Circular Strip is required, and one of its applications of this kind is illustrated in the panel. In this case it is used as a slip ring for collecting the current supplying the lamps in the rotating structure of a model Flying Machine. The superstructure rotates on two 3" Pulley Wheels, the lower one of which is supported on Double Brackets to allow clearance for the Gear Ring. The Ring is insulated from the base by Insulating Bushes and Washers placed on the 6 B.A. Bolts holding it in place. The accumulator is connected to the Gear Ring and also to the frame of the model. To collect the current from the Gear Ring a Pendulum Connection is attached to the upper structure but insulated from it, and made to bear lightly on the Ring. The current returns through the frame of the model.

The Gear Ring may be mounted in a similar manner to that described above and used for rotating the superstructure of the model. With the part bolted to the fixed base, the power unit would be mounted in the upper structure; but a more usual arrangement would be to mount the Motor in the base and bolt the Gear Ring to the rotating structure. A ½" Pinion engaging the outer teeth of the Ring should be driven from the Motor.

The possibilities of a Gear Ring for obtaining a reduction gear should not be overlooked. When suitably mounted and driven by the internal teeth, it will be found that driving and driven Rods rotate in the same direction, whereas two external gears would rotate in opposite directions to each other. The parts may be bolted directly to the road wheels of a model tractor, etc., for supplying the drive, which may be taken to the outer or inner set of teeth. In such a case it would be a simple matter to arrange a two-speed gear by meshing ½" Pinions both inside and outside the Gear Ring, and changing the drive from one to the other as required. The changing of the drive may be effected by means of Dog Clutches or by sliding Gears.

MAKING LARGE BOBBINS

In large electrical models the standard-sized Meccano Bobbin is sometimes found too small to give satisfactory results as an electro-magnet. The difficulty can easily be overcome by building up a core of Meccano Strips and using stout cardboard for the cheeks. The required number of Strips should be clamped together by means of Screwed Rods at each end. The length of the core is determined by the length of the Strips used, and the thickness depends upon the number of Strips employed. A handy size may be made from forty-five 2" Strips clamped between Screwed Rods and carrying at one end Angle Brackets for fixing the core in place on the model. At the other end the Strips may be fitted between a 1½" × ½" Double Angle Strip. The core so formed is provided with two coil cheeks of stout cardboard measuring approximately 2" × 1", with a rectangular hole 1½" × ½" cut out of the centre. These form the limits of the windings, and to prevent damage to the wire the space between the two cheeks should be wrapped round with stout paper before the wire is wound on. When the coil is complete it is advisable to wrap a layer of paper round the outside to protect the wire. This precaution often prevents trouble arising as the result of the insulation of the wire being damaged and causing short circuits.

EXTENDED COMPRESSION SPRINGS

It sometimes becomes necessary to employ a light compression spring of greater length than the standard part, and the obvious means of obtaining such a spring is to bring into use two or more short Springs. Constructors who have tried this method will have found that after a period of use the parts work one into the other, the effective length eventually becoming reduced to that of a single Spring. To overcome this trouble a washer should be placed on the Rod between each Spring. This prevents them from intertwining, and by adding extra Springs almost any length may be obtained. It should be remembered that this method of construction is only suitable where both ends of the Springs are closed, and cannot be used in models such as a spring gun where the compressed Spring is suddenly released to catapult a washer off the Rod. If more than one Spring is used for this purpose the obvious result will be for the extra Springs also to shoot off the end of the Rod.

SLIP RINGS FOR LARGE MODELS

A large model in which the upper portion is made to rotate frequently presents difficulty when it is desired to fit an Electric Motor or illuminate the rotating structure. Obviously wires cannot be connected to the rotating portion of the model, so that some form of slip ring must be devised.

A current collector for models incorporating the Roller Bearing Unit, Part No. 167, can be devised by forming two circles of 4½" Curved Strips and bolting these above and below the Ring Frame. For this purpose 6 B.A. Bolts (Elektron Part No. 1575) should be used, and although the two circles should be connected together electrically, they should be insulated from the Ring Frame by means of 6 B.A. Bushes and Washers (Elektron Part No. 1570). A Pendulum Connection attached to the base of the model, but insulated from it, forms a brush and bears against the lower circle of Strips; and a second Pendulum Connection attached to the rotating superstructure, but insulated from it, bears against the upper set of Strips.

To connect up for driving an Electric Motor, one wire should be attached to the upper Pendulum Connection and to one of the Motor terminals, the other terminal being connected to the frame of the model. The lower collector brush is connected to the Accumulator or Transformer, the second terminal of which is attached to the base of the model.

CRANE JIB CONSTRUCTION

The jib of a model crane must be made as light as possible consistent with strength. A heavy jib requires considerable power for raising and lowering, and consequently several stages of reduction gearing must be fitted between the Motor and luffing barrel, so that the luffing operation is somewhat slow. Also, if the jib is too heavy the crane will have a tendency to overbalance, and even with a light jib it is often necessary to add counterbalance weights to overcome this. A strong and rigid jib can be constructed from Angle Girders, which are made to form a square section girder by means of Strips, additional Strips being added for diagonal bracing.

A jib of much lighter construction can be made from Braced Girders, and although perhaps not quite so rigid as the usual type, it will be found sufficiently robust for most models. The Braced Girders are made to form a large girder of square section by bolting them together by means of Angle Brackets. These should be placed at regular intervals along the sides of the Girders to prevent any tendency to buckle. The ends of the jib may be finished off by means of Strips or Angle Girders, and a jib of any length can be made by adding extra Braced Girders.

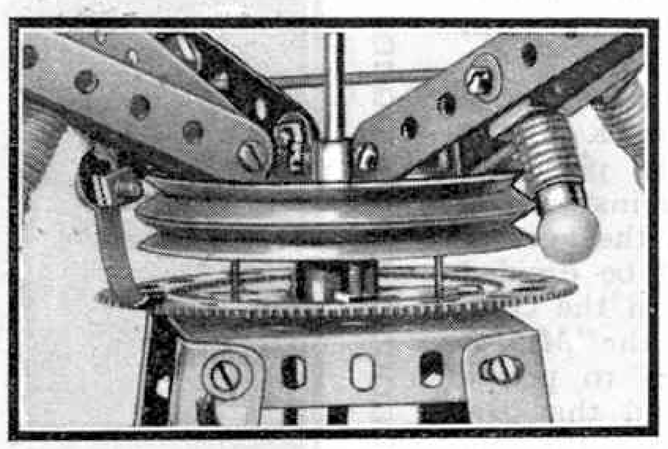
BOILER MODIFICATION.—The present design of the Boiler (Part No. 162) enables it to be opened out or contracted to make cylinders of various diameters, and your proposed tubular cylinder would not possess this very useful feature. The present Boiler can be bolted up to make a tube of fixed diameter, and the row of slotted holes allows for slight adjustment so that the Ends fit tightly. Your suggestion appears to be prompted by the tendency of the Boiler Ends to slip off after the Boiler has been in use for some time. This trouble may be overcome by opening the boiler slightly. The latest pattern Boiler Ends are perforated and may be bolted in position if desired. (*Reply to B. Pattrick, Huddersfield.*)

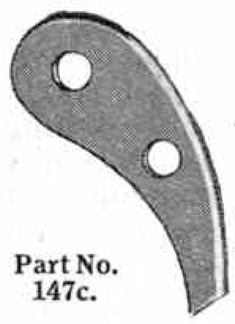
New Meccano Parts

Part No. 180.

No. 180, Gear Ring, 3½" diameter, 95 internal teeth, 133 external teeth. Price 2/- each.

The illustration on the left shows the new Meccano Gear Ring. This part, which resembles a Circular Strip, has an inside diameter of 2½" and an outside diameter of 3½" and is provided with 95 internal teeth and 133 external teeth. It will be found extremely useful in numerous different types of gear boxes. It is specially suitable for reproducing epicyclic gearing, but it can be used in almost any instance where an internally toothed gear is necessary. In addition it can be used where a small Circular Strip is required, and in the illustration below it is shown in use as a slip ring for collecting the current used for illuminating electric lamps fitted to the revolving superstructure of a model Flying Machine. The uses of the part are dealt with in detail on this page.





Part No. 147c.

No. 147c, Pawl without Boss.
Price 1d. each.

This part resembles Part No. 147a, but is without a boss. The new Pawl can be mounted on a 5/32" Bolt provided with two nuts for fixing it in position.

OBJECTS of the GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

The Meccano Guild

Preparing for the Christmas Season

It seems a little early to be thinking of Christmas festivities, but it is really by no means too soon to begin preparations for the Exhibitions, Concerts and Social Evenings that mark this happy season. I hope that in every club these preparations are already being made in order to ensure that members shall have the greatest possible amount of fun when the holidays arrive, and that club programmes from now until then will be increasingly enjoyable in order to lead up to a grand climax at the end of the year.

Value of Model-Building Contests

Although new hobbies and games are continually being introduced, model-building is pursued with unabated vigour in every club. This is only natural, for the desire to enjoy the Meccano hobby in the company of others interested in it is the impulse that causes boys to become members of Meccano Clubs. Most club enthusiasts find that competitions provide the most fun in model-building, and contests in great variety are available for both large and small clubs.

In arranging model-building competitions, care must be taken to work out the details carefully in order to place all entrants on a fair basis. For instance, if there is a wide variation in the ages of members, the entries should be divided into age groups, as is done in the competitions that are announced in the "*M.M.*" If careful attention is given to points of this kind, it will be found that the rivalry provoked will increase the fun of club life, and will encourage members to be both original and thorough in their methods.

Two chief types of competition have been worked out by the officials of the most successful Meccano Clubs. In one of these, models of a given type, such as cranes, motor cars or ships, are to be built, no restrictions beyond fixing the subject being imposed. A contest of this kind enables members who are observant and enterprising to develop skill in reproducing interesting mechanisms of all kinds. In the second type of competition members are required to show ingenuity in overcoming special restrictions. Simplicity Contests, and those in which entries are to be built from a fixed number of parts, belong to this class. The restrictions should be calculated to give entrants a fair chance of making a good show, and it is a mistake to pile up difficulties to such an extent that really productive model-building is nearly impossible.

Competition is stimulated and interest increased when small prizes are awarded to the winners of competitions. In some clubs small prizes are given to the winners of each competition ; in others marks awarded in individual contests are added up at the end of each session in order to settle the destination of the prizes. In some respects the second system is the better, for it ensures that continued application in club activities is rewarded.

Meccano Club Secretaries

No. 28. S. Major

S. Major is secretary of the Hutton Modern School (Bradford) M.C. This club was affiliated in March this year. The programme includes Model-building Evenings, Hornby Train Nights and Games, and members show great enthusiasm and ingenuity in suggesting means for increasing their enjoyment of club meetings.

A Successful West Country Club

The official connection of the Exeter M.C. with the Meccano Guild began in 1925, but the club had already been in existence for eight years, and Mr. M. C. Hodder, its Leader, had taken charge of its activities as early as 1920. In its earliest days it was remarkable for its enterprise, and Mr. Hodder was tireless in introducing new schemes to arouse the interest of members and to encourage their loyalty to their club.

Affiliation with the Guild was followed by remarkable progress and the club's model-building activities aroused great interest. A model of Exeter Cathedral attracted the attention of the Cathedral authorities, and afterwards Meccano tramcars large enough to accommodate two members of the club, and a representation of an elephant on which a boy could ride, astonished the citizens of Exeter and on special occasions provided great fun for them and for the members.

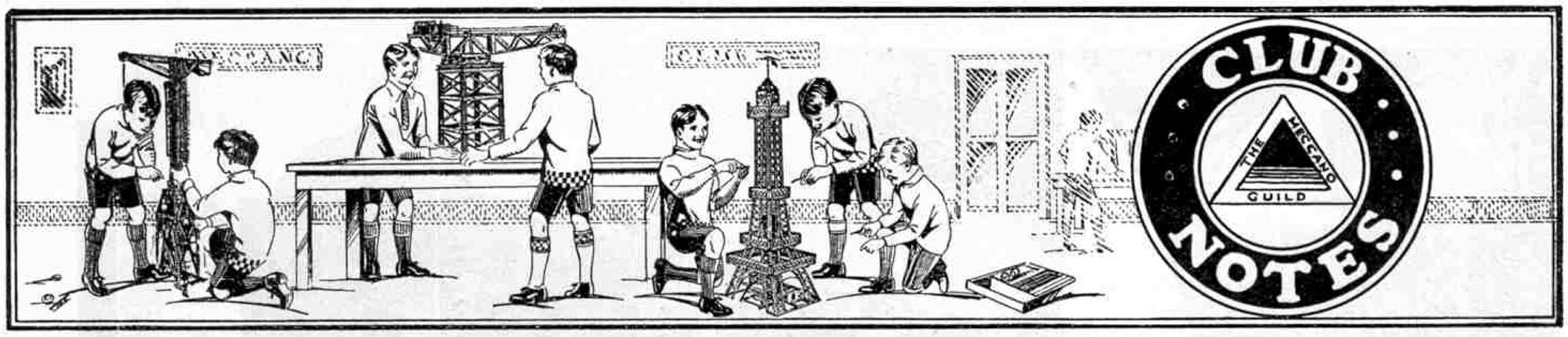
As readers of the "Club Notes" page will have noted, the most recent scheme is the construction of two large workshops crowded with novel and interesting machinery, including power presses, cutting machines and tapping machines, all driven at their correct speeds by means of shafting, sprocket chains and belts of Meccano Cord. Both models are faithful copies of the machine shop of a large engineering works in Exeter, and ingenious counting machines record the total amount of work done in them at each meeting. Obsolete machines are constantly being scrapped and replaced by new and more ingenious contrivances. Thus interest is fully maintained, and every member is given an opportunity of suggesting improvements and additions.

The secret of the club's continued success is the encouragement given to members to suggest new ideas and to put them into operation. The Leader remarks that although the club is one of the oldest connected with the Guild, yet in a sense it is always the newest, for a constant stream of recruits is encouraged, and as many members as possible are given opportunities of taking part in the direction of affairs. The result is that the club is run largely by the members themselves, and fresh and original schemes are always being worked out.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters, whose names and addresses are given below :—

DUTCH EAST INDIES—J. J. D. Kruyt, Wajanglaan 28, Bandoeng.
EAST KIRKBY—R. E. C. Kemp, 5, St. Thomas' Avenue, East Kirkby, Notts.
HARROW—Mr. J. W. Stewart, B.Sc., Claremont Avenue (Senior) School, Kenton.
HERTFORD—G. F. Roberts, 13, Bengeo Street.



Middlesbrough M.C.—The Swimming Section recently concluded a successful season in which nine out of 14 members learned to swim. The Section secured affiliation to the Middlesbrough Amateur S.C. Cricket was another activity during the summer sessions and the club won a record number of matches. A programme of the usual varied and attractive type is now being followed. Club roll: 38. *Secretary:* L. Weighell, 42, Bishopton Road, Grove Hill, Middlesbrough.

St. Peter's (Wolverhampton) M.C.—Club activities were resumed with great enthusiasm after the holidays. Special interest was shown in operations on the Hornby track laid down during the summer. This has had time to settle and excellent timetables have now been worked out. New members are required, and the secretary will be pleased to hear from Meccano enthusiasts who wish to join. Club roll: 10. *Secretary:* V. Biddulph, c/o Westminster Bank, Lichfield Street, Wolverhampton.

Ipswich M.C.—The first meeting of the winter session took the form of a concert at headquarters. Many of the items were given by members, who had practised hard for several weeks, and the club orchestra greatly distinguished itself. A large audience enjoyed every minute of the entertainment. Club roll: 15. *Secretary:* D. Green, "Bankside," Belstead Road, Ipswich.

Sid Vale M.C.—The third Annual Exhibition was held in a tent on the Bedford Lawn. The chief attraction was a realistic model of a stone quarry, in which miniature pneumatic drills, draglines, and other accessories were hard at work. The number of working models in the quarry was 26. The Exhibition was open for three days, and a large sum was collected in boxes placed on the tables. Among the visitors were members of the Exeter M.C., who spent an enjoyable day at Sidmouth. Club roll: 20. *Secretary:* L. R. I. Gliddon, Sheffield House, Sidmouth.

St. Nicholas (Sevenoaks) M.C.—A group of members visited the works of Cadbury Bros. at Bournville, and a club model of the works was afterwards constructed. This was displayed in the window of a local confectioner. A Lantern Lecture on a tour of Bournville has been given, the proceeds being devoted to club funds. Club roll: 17. *Secretary:* J. Kemp, 2, Bosville Road, Sevenoaks.

Laindon M.C.—A special feature of the summer session was work on the club's outdoor Hornby Train layout. This was laid out in realistic surroundings, with earth embankments and other interesting accessories. Model-building is now the chief attraction. A successful competition for aeroplane models was held, the entries being of a very high standard. Club roll: 14. *Secretary:* A. G. L. Schofield, "Highfield," Inverness Road, Laindon, Essex.

Plymouth M.C.—Visits have been paid to the G.W.R. Docks, and the City Electricity and Gas Works. At the Gas Works special interest was taken in the plant from which Benzol is extracted for use in connection with the running of Plymouth omnibuses, and in the overhead Telpher system employed. Mr. W. Rose, F.M.S., the famous Plymouth model-maker, has been elected Vice-President of the club. Club roll: 69. *Secretary:* R. Job, 89, Foliot Road, Swilly, Plymouth.

Fulstow Junior M.C.—Members spent a day at London, the tour being arranged by Mr. W. R. Phillips, Leader of the club. Although time was limited, members visited the Tower, the Science Museum at South Kensington, where the "*Rocket*" aroused great interest, the Natural History Museum, the Zoo and many other places of interest. Members reached home tired but happy at 3.30 on the following morning. Club roll: 11. *Secretary:* S. Doe, The Stores, Fulstow, North Thoresby, S.O. Lincs.

John Gulson Senior Boys' School M.C.—There is keen competition among members to secure good marks in the sessional contest, in which points are awarded for Model-building, Lectures, readings and other contributions to the programme. A special contest in which entrants had to submit Hornby Train layouts led to difficulty in selecting the winning entries, because of the interesting layouts submitted. A football team has been formed, and plays matches regularly. Members are now looking forward to the Exhibition, to be held about Christmas, and are busily preparing models and other material in connection with this event. Club roll: 18. *Secretary:* H. Ludgate, 46, Fynford Road, Radford, Coventry.

Abington M.C.—Great keenness marked the opening of the first winter session. Mr. J. Watkins, former Leader of the club, has retired and Mr. Dodman, a master of the Northampton Grammar School, has kindly undertaken the duties temporarily. The session began with a talk by Mr. Dodman on "*Wireless.*" Other meetings have been devoted to intensive model-building activities. Club roll: 26. *Secretary:* S. Cocking, 4, King Edward Road, Northampton.

Hornsea M.C.—The club has been fortunate in having new Hornby Train material placed at its disposal, and the club's layout has been considerably extended. Model-building with the club stock of parts has been carried on at other indoor meetings. Outdoor events have included a visit to a box-making factory; and football, evening games being played regularly until the days became too short. Club roll: 85. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Kendal M.C.—So far the meetings of the first winter session have been devoted to model-building, excellent representations of the "DO.X" flying boat, and a steam crane having been built, in addition to a novel racing car. Preparations are now in progress for the club's Exhibition, to be held during December. New models are being constructed, and the club's Hornby Train material is being overhauled. One of the attractions is expected to be an electrically-lit train that will run in a darkened room, and there will also be a Cinematograph Show, the programme of which will include "*The Wrecker.*" Club roll: 12. *Secretary:* L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

Greenock Academy M.C.—Indoor and outdoor sections have been formed, as usual in this club, and splendid programmes have been arranged. These include Model-building Contests, Lantern Lectures and other indoor attractions, and special arrangements have been made for visits to ships in the docks and yards of Greenock, events that should give excellent subjects for future Model-building activities. Club roll: 75. *Secretary:* D. M. R. Steel, 25, Margaret Street, Greenock.

Malmesbury School Society M.C.—The membership roll has reached the splendid figure of 90, and the club has made such good progress that affiliation has been secured. Meccano Model-building and other hobbies are arranged for in the programme, and a special feature is being made of Lantern Lectures. Members are building models of famous bridges of various types, and these are to be exhibited at the Christmas parties held in the school. Club roll: 90. *Secretary:* R. Martin, Secondary School, Malmesbury.

Longdendale M.C.—Affiliation has now been secured and an interesting programme has been arranged in which all the members take part. An interesting feature is Discussion Evening, when models built by members are examined and criticised, a method that should lead to a higher standard of model-building. The models shown at the first of these meetings were a tractor and an aeroplane. A Cinematograph Entertainment has been given by one of the members. Club roll: 8. *Secretary:* V. Morris, Hadfield Road, Hadfield.

Millwall Central School M.C.—Members have been divided into gangs for model-building purposes, and most meetings have been devoted to constructional work. Lantern Lectures on engineering subjects and others of interest to Meccano enthusiasts are given monthly by Mr. C. B. Bending, Leader of the Club, and short papers are read by members. Club Roll: 16. *Secretary:* C. Shaw, Millwall Central School, London, E.14.

A group of members of the Mary Swanwick School (Chesterfield) M.C., with Mr. C. C. Handford, Headmaster of the School and President of the club, and Mr. T. E. John, Leader, on the right and left of the certificate respectively. The club was affiliated in December, 1932. It was founded by Mr. John and under his energetic direction members have become keen and skilful model-builders.

AUSTRALIA

Sydney M.C.—A new club room has been obtained and members have been busy fitting this up for model-building operations. A recruiting campaign has been organised, as the new premises provide better facilities for extension. Mr. W. J. T. Watson has been elected Leader of the club, and efforts are being made to co-operate more closely with the Melbourne M.C. and other Australian clubs in order to strengthen the club movement. Club roll: 14. *Secretary:* W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W., Australia.

NORWAY

Sandefjord M.C.—The summer session was brought to an end with a camp in mountainous country, members enjoying rambles and climbs, on one of which they reached the summit of Gansta, 6,270 ft. in height. Cycle runs also were arranged. At model-building meetings, various types of bridges have been constructed. A lantern lecture on "*Lighting Systems*" was illustrated by means of models and was followed by a keen discussion. Club roll: 6. *Secretary:* T. Jacobsen, Jernbanealleen, Sandefjord, Norway.

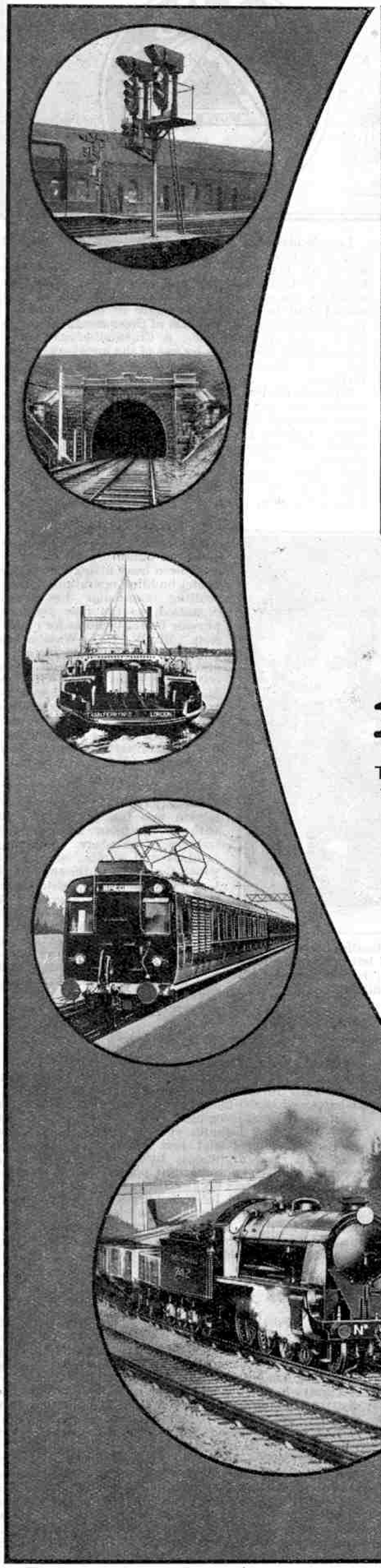
SOUTH AFRICA

Malvern M.C.—Members have been very active recently. The chief outdoor event has been the 20-mile cycle race for the club trophy. Magazine Night, Debates and Model-building Contests have been held, in addition to Social Evenings. The subject of one of the most interesting Debates ever held was the relative merits of classical and jazz music. The debaters reinforced their arguments by playing gramophone records to illustrate important points, and the subsequent discussion was very exciting. The Rev. A. Ross, who was detained in Johannesburg by a road accident, gave a talk on native missionary work in Central Africa, in which he dealt with interesting features of native life and big game hunting. *Secretary:* C. D. Slade, P.O. Box 8, Cleveland, Johannesburg.

Clubs Not Yet Affiliated

Algoa (Port Elizabeth) M.C.—This newly-formed club meets weekly at the Port Elizabeth Technical College. Members have taken part in Model-building Contests and have built large club models, and Stamp Collecting has been introduced as an additional hobby. A Library has also been formed. Meccano boys in the district are invited to join the club, and the secretary will be pleased to hear from intending members. *Secretary:* F. W. Wilson, 49, Parliament Street, Port Elizabeth, South Africa.

Petone M.C.—Excellent progress is being made. Model-building is the chief attraction, and talks on constructional methods are given regularly. Special models are constructed at each meeting, the subjects being decided by ballot. A Hornby Railway has been laid down and members are becoming expert in despatching and running trains. Club roll: 16. *Secretary:* E. Speers, 70, Cuba Street, Petone.



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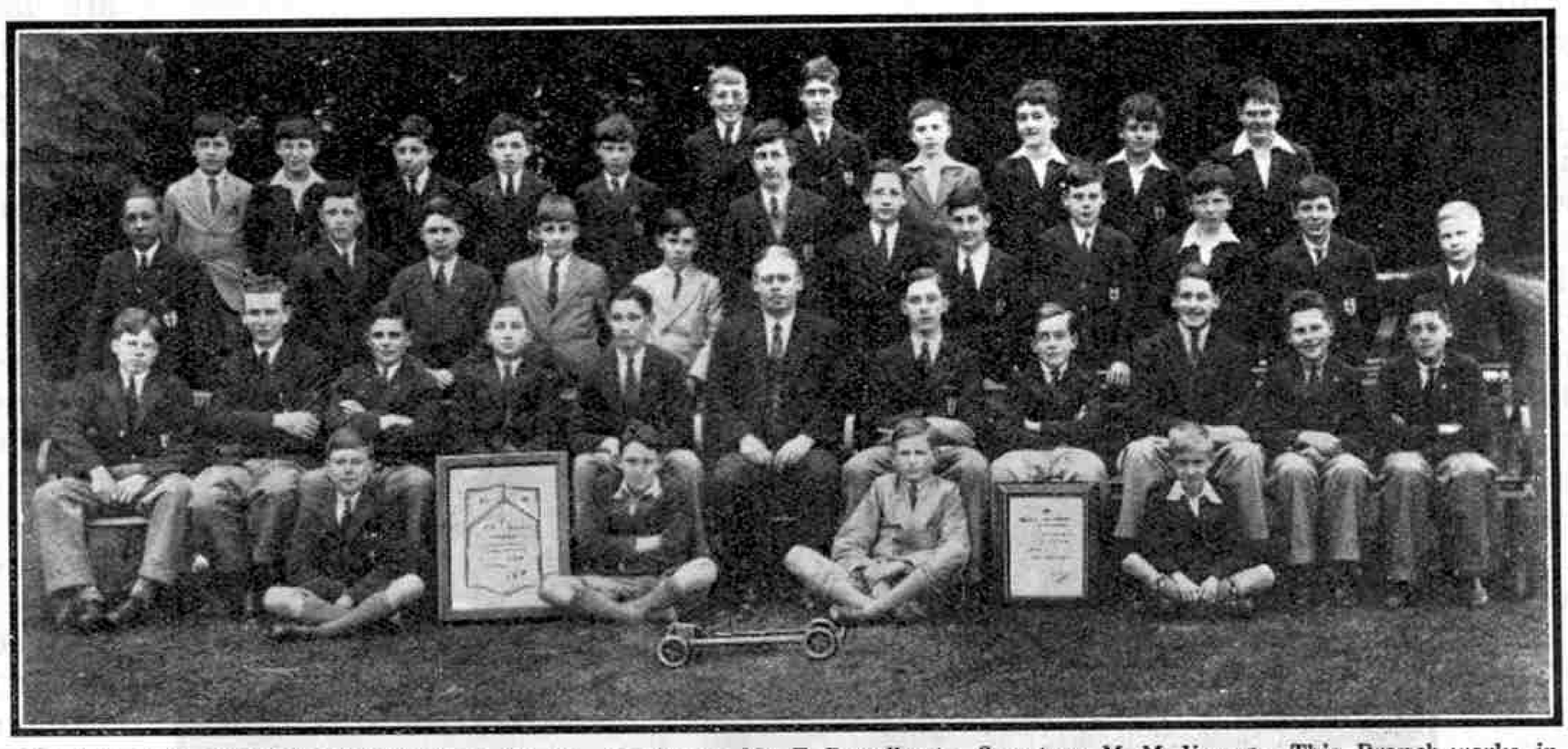
Branch Notes

LORDSHIP LANE.—Members paid an enjoyable visit to the Stratford locomotive sheds of the L.N.E.R. A "Sandringham" was minutely inspected and driven up the yard while the visitors were in the cab. An equally interesting visit was paid to the S.R. locomotive depot at Nine Elms. Secretary: R. Carrington, 49, Russell Avenue, Noel Park, Wood Green, N.22.

WHITGIFT SCHOOL.—Special experiments are being made with a series of carefully worked-out timetables, printed copies of which are distributed to members at track meetings. A visit has been paid to the local Fire Station. A Library has been started to enable members to increase their knowledge of railways and railway practice. Secretary: M. M. Young, "The Corrie," Manor Way, Purley, Surrey.



Members of the Whitgift School Branch, No. 67. Chairman, Mr. F. Broadbent; Secretary, M. M. Young. This Branch works in conjunction with the Whitgift School M.C., joint excursions and special meetings being arranged regularly. A visit was paid recently to Liverpool, where the docks and the Meccano factory were inspected.

ELMSIDE (EXETER).—Excellent progress continues to be made, and operations are conducted nightly on the Branch track, traffic always being heavy. A new scheme of working has been introduced, a pair of members being made responsible for the running of each train included in the service operated. An automatic loader for sacks of grain and similar materials has been satisfactorily completed, and a goods train can now be fully loaded in a very short time. Rolling stock has been overhauled in preparation for the winter sessions. A Library has been started and a Games Championship organised. Secretary: D. Legg, 25, Chute Street, Newtown, Exeter.

HOLYWELL (OXFORD).—Interesting tests of locomotive speeds were won by a Hornby L.N.E.R. "*Flying Scotsman*," the next best being an L.M.S.R. No. 2 Special Tank. A locomotive repair depot has been organised in order to deal with breakdowns. Outdoor events have included a visit to the G.W.R. Oxford locomotive sheds. Secretary: M. Weatherall, 29, Holywell, Oxford.

GROVE PARK.—The Branch has moved into new headquarters, and the opening meeting took the form of a Tennis Tournament. Members also played other games, and refreshments were provided, the meeting concluding with a long period of track operation. Regular track meetings have been varied by Debates on general railway topics, and various indoor and outdoor games. Secretary: B. Chandler, 29, Ellesmere Road, Chiswick, W.4.

STREATHAM PARK.—At each meeting the Branch track is arranged to represent a section of the L.M.S.R. system, and trains are run on it in a similar manner to operations on the prototype. At recent meetings services between Euston and Liverpool, Birmingham and other large centres on the L.M.S.R. have been operated. Owing to the interest of parents of members, a special demonstration was arranged, and a large number responded to the invitation to attend. A Social Evening also has been held. Secretary: J. B. Cass, 161, Ribblesdale Road, Streatham, London, S.W.16.

CHARMINSTER (BOURNEMOUTH).—The Branch track has been relaid and interesting operations have been carried out on it. Before the beginning of the winter sessions a group of members camped out near Winchester, and during that time spent busy days in the harvest fields, being particularly interested in the work of the tractors employed. Track meetings were resumed in September and have provided members with many interesting problems in arranging timetables. Secretary: B. Guttridge, Tudor House, Malvern Road, Bournemouth.

BLACKPOOL (NORTHERN SECTION).—The Branch layout has been further extended and a large continuous track is now in operation. A low-level goods yard to accommodate 50 wagons has been completed, and realistic embankments have been built. A wireless set has been installed in the Branch room. The aerodrome now presents a busy scene at meetings, and members are building aeroplanes as entries in a competition for a special cup. Secretary: K. G. Davidson, 14, Sutherland Road West, Blackpool.

AUSTRALIA

MELBOURNE.—Members took part in an exhibition arranged on behalf of a suburban church. The electric railway of Mr. L. Ison, Chairman of the Branch, was on view, working mechanical models being incorporated in order to add to the realism of the layout. The Branch display was the chief attraction of the Exhibition. Visits have been paid to the model railway layout of Mr. R. Pearson, and to a display of models arranged by a local model engineering club. A scheme is now being discussed for the formation of suburban branches to take the place of the present central Branch. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

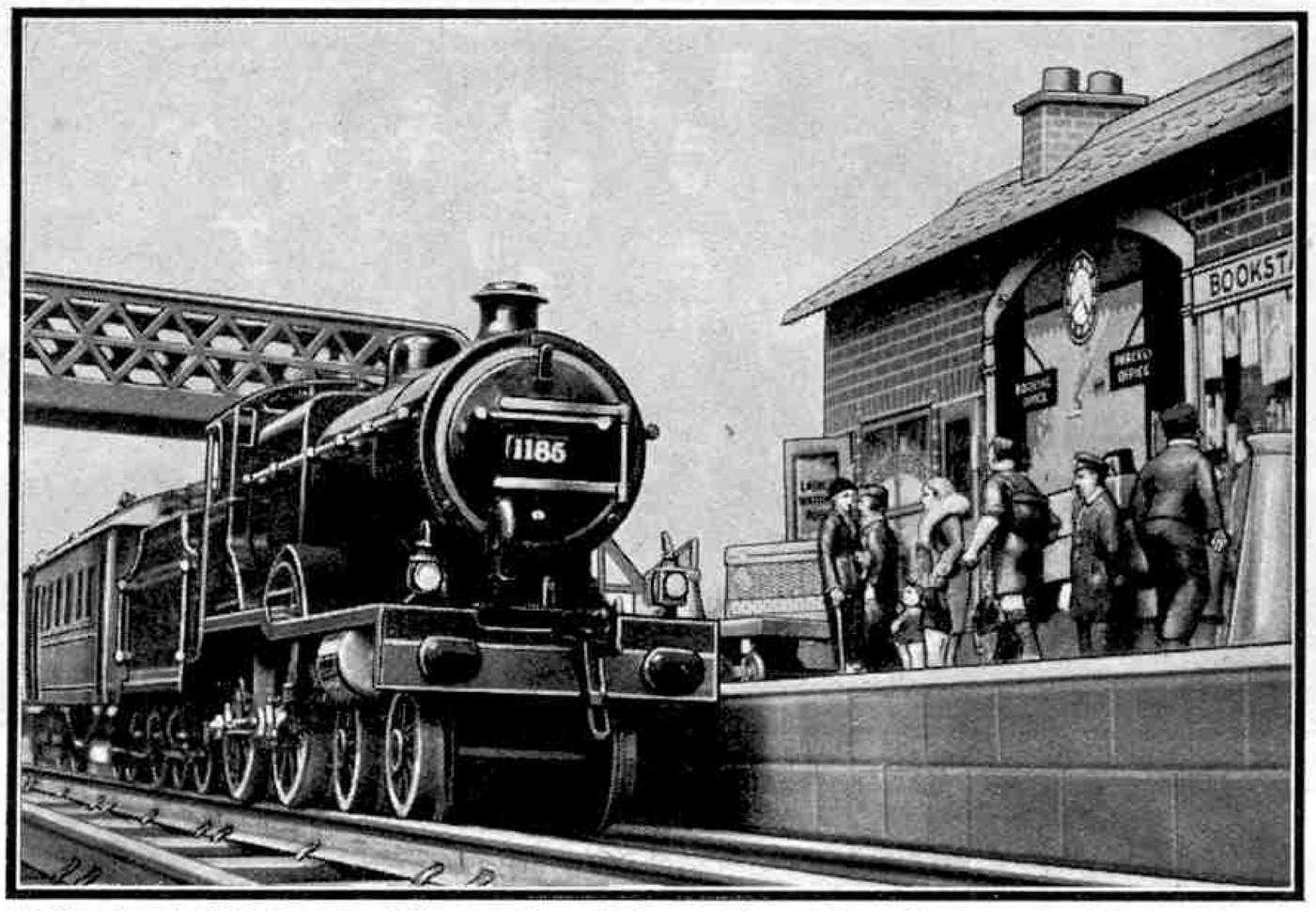
LONDON—W. J. Parker, 27, Woodgrange Avenue, North Finchley, N.12.

LONDON—J. Price, "Mancroft," Windsor Road, Church End, Finchley, N.3.

NEW ZEALAND—Byron Lumsden, 2, West Street, Feilding.

LIX.—A HORNBY "CALEDONIAN" SYSTEM

FROM time to time in these pages we have described interesting train operations of real practice and have made suggestions for their reproduction on miniature layouts, using the various components of the Hornby Series. In addition we have dealt with the characteristic features of various sections of the four group railways. As a result of these articles many interesting layouts have been developed by H.R.C. members, each following his own favourite railway or section. We are constantly receiving details of such layouts, and as an example we illustrate this month the plan of the Hornby railway layout operated by J. L. Stevenson of Colinton, Midlothian, the prototype of which is the Caledonian section of the L.M.S.R. main line between Edinburgh and Carlisle. The owner of the layout has made a special study of the operating characteristics of this section, and has reproduced many of them with success. The main plan might be made to represent many other sections of railway, however, and the details could be modified to suit different conditions.



A Hornby L.M.S.R. No. 2 Special Locomotive entering a station. This engine is very suitable for miniature Scottish layouts, as its prototype is widely employed north of Carlisle.

For reasons of space only one terminal station is available, which serves to represent Edinburgh or Carlisle, as required by the operations being carried out. In order to obtain a good length of run the main line is continuous, and in order to enable trains to return to the starting point without the troublesome process of reversing, a return loop is incorporated, thus forming practically a letter S inside the main oval.

Main line traffic, both passenger and goods, is operated, and there is also a considerable suburban traffic from "Edinburgh" to "Barnton" direct, and to "Balerno." It will be seen that the winding character of the Balerno branch in actual practice is well reproduced when it is realised that trains in miniature run from Edinburgh on to the main oval, past the intermediate station, and then traverse the return loop. They continue round the main oval, and finally take the right-hand points that lead to the branch station. The intermediate main line station represents Slateford when this service is being run. The proportion of curved track passed over by the Balerno trains is thus remarkably high, even for a miniature system.

Ample accommodation is provided at the terminus for dealing with trains. Although no "run-round" roads are laid down for arriving engines, and the turntable is situated within the main oval, it is not really difficult of access from the station. In any case the locomotive stud is sufficiently numerous—10 in all—to enable turnover locomotives to take up the working during busy times. The engine sheds are reached by means of the turntable, an arrangement that is particularly useful where space is limited. A coaling stage is an interesting feature of the locomotive yard, and a breakdown train is kept ready for emergencies.

The exit from the terminus is laid on a gradient, which enables gravity shunting of both passenger and goods trains to be carried out. Station work is thus performed rapidly and with a marked economy of engine power. The goods depot adjoins the passenger station, which is a convenient arrangement in certain circumstances; and there is also goods accommodation at the intermediate main line station. A very complete goods service, of both through and pick-up trains, can thus be run in addition to the passenger trains.

The various services run represent the chief activities of the L.M.S.R. on the section of line that is modelled. Good use is made of the H.R.C. Working Timetable Forms by the operators, who are usually two in number. An interesting point is that the Stationmaster's Report Forms are filed away, so that a complete record is available of all the operations carried out on the layout.

Main line trains are arranged to pass round the main oval several times, the intermediate station representing Carstairs, Symington and Beattock on successive circuits southward. This is a scheme necessarily adopted on many continuous layouts where the train has to pass the same station each time round. Where frequent trains on a systematic basis are being run the operators have little time to notice a detail of this kind, and the effect is not so unrealistic as might at first be supposed.

There are several true-to-type engines for the chief trains, and the usual accumulation of miscellaneous types for ordinary work. Two Midland Compounds are used a good deal for expresses, though a miniature "Royal Scot" is available also for heavy turns. A No. 1 Special Tender engine occasionally takes a share in passenger work, but is kept more particularly to long-distance goods trains. Its use on secondary passenger trains is quite reasonable, as goods engines are frequently employed for such duties in actual practice. The suburban trains are ably handled by a No. 1 Special Tank and a No. 1 Tank, while a No. 1 Tender engine is also mainly used for this work.

The pilot and train locomotive of a Hornby express on a miniature L.M.S.R. Caledonian section layout. These represent the two engines often used in actual practice on "The Royal Scot" between Carlisle and Symington, as described in this article.

The Barnton service is worked in a satisfactory manner, and really requires little comment except to note that a turn-over locomotive has to be provided to work the train back again after it has arrived at Barnton. The Balerno service is operated as previously described, and a loop road is provided to run the engine round the train although not shown in the diagram. A point of interest in connection with the Balerno branch in actual practice is that owing to its sharply-curved nature special four-wheeled coaches are used on it, and only a limited range of tank locomotives. This feature is reproduced on the miniature line by the exclusive employment of No. 1 Coaches and the corresponding Guard's Vans. These are close-coupled, as suggested several times in these pages, to form a set train, so that they are particularly appropriate for the service. Similarly only four-wheeled tank engines are used for the operation of these trains.

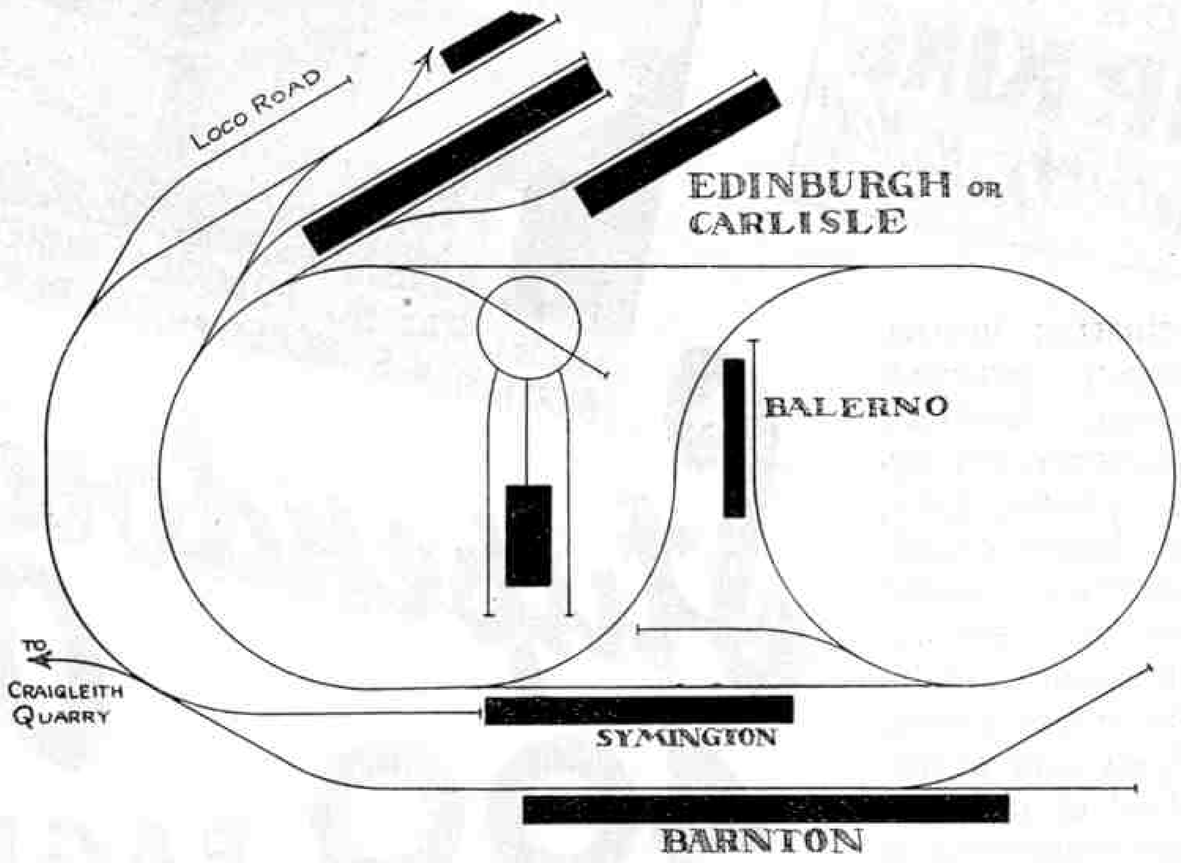


Diagram of the miniature "Caledonian" layout.

Of the main line trains that might be operated on such a layout, the most important would no doubt be the Edinburgh portions of the up and down "*Royal Scot.*" In actual practice these are attached to or detached from the Glasgow section at Symington, but on this miniature layout they would have to be run separately to and from Carlisle, as no provision is made for Glasgow traffic. Of course if the terminus is assumed to represent Glasgow temporarily, the combined train could leave "Carlisle," pass "Beattock" and arrive at "Symington." Division of the train would then take place, and both portions would be dealt with in turn, each taking the return loop to arrive at the terminus.

The goods siding at the intermediate station could be used to accommodate the engine waiting to take the Edinburgh coaches, the train engine proceeding with the Glasgow part from "Symington." Alternatively another method of working that has been used to some extent in actual practice might be adopted. The combined train leaves Carlisle in charge of two standard compound locomotives. At Symington the pilot goes off, the train engine takes the Glasgow portion, and the pilot takes on the Edinburgh portion. This could be done quite well on the layout we are discussing. On arrival at the intermediate station the pilot engine would be uncoupled and run into the goods siding. The operations would then be the same as in the previous arrangement, both trains reaching the terminus by means of the return loop.

One of our photographs shows a double-headed express at a station, and is interesting in that the train engine is a Hornby L.M.S.R. Compound, but the pilot is of the "2P" class rebuilt from a standard No. 2 Special Locomotive, as described in the "*M.M.*" last February. This engine would be particularly suitable for working the Edinburgh portion, as this in actual practice is lighter than that to Glasgow.

Although no signals are shown in the diagram, the actual layout is fully equipped with Hornby Signals. These are particularly suitable, for with their lattice posts and tall spiked finials, they imitate successfully the standard signals used on the Caledonian section of the L.M.S.R.

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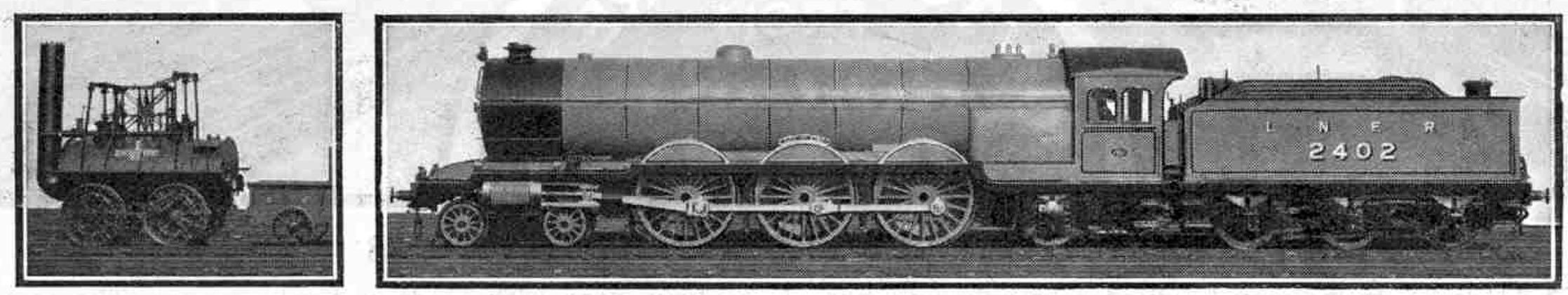
H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Meccano Ltd., Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on the back of every sheet of paper used.

LOCOMOTIVE PROGRESS CONTEST



It is now more than a century since the steam locomotive was first successfully used for railway work, and the great difference between the earliest locomotives and those of the present day is shown in a striking manner in the illustration at the top of this page. This depicts "*Locomotion,*" the first locomotive owned by the pioneer Stockton and Darlington Railway, and built by Stephenson in 1825; behind it is a giant "Pacific" locomotive, the "*City of York*" of the L.N.E.R. The contrast between the two is remarkable. Apart from the great difference in size, the symmetrical outline and generally finished appearance of the modern locomotive make its ancestor look extremely crude.

Similar principles for the development of power are embodied in the design of both these apparently dissimilar engines. The conversion of water into steam, and the action of this steam in the cylinders imparting motion to the engine and its load, are essential features in each. As a result of constant development and refinement in design, however, the modern engine is many times more powerful and efficient.

H.R.C. members will find it of interest to decide what are the main features or developments of design that have caused the present-day locomotive to be so greatly superior to its forerunner. We have therefore settled upon the following points as a basis of comparison in which "*City of York*" excels "*Locomotion.*" These are 1, power and speed; 2, smoothness of running; 3, economy in fuel and water; 4, length of continuous run; 5, safety in operation. For the subject of our competition this month we want H.R.C. members to consider each of these five headings in turn, and to state briefly under each the features included in the design of "*City of York,*" and not in "*Locomotion,*" that account for the superiority of the former. Prizes will be awarded to the competitors who, in the opinion of the judges, give the most complete account of the features under the various headings.

The contest will be divided as usual into two sections, Home and Overseas. In each section the prizes will be Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be given to those members whose entries are not among the winners of the major awards, but deserve some reward.

Envelopes containing entries should be clearly marked in the top left-hand corner "*H.R.C. Locomotive Progress Contest,*" and should be posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 30th November. The closing date for the Overseas Section is 28th February, 1934.

Competitors are reminded that their full name and address, and H.R.C. number, must be clearly written on the back of each sheet of paper used.

Layout Planning Contest

By this time almost all miniature railway enthusiasts will have again brought their indoor railways into operation, possibly after a holiday from railway affairs, or after a period of working an outdoor layout during the summer months, and in almost every case changes in layout will be contemplated in order to increase the realism with which operations can be carried out. We are greatly interested in the ideas of H.R.C. members for improvements of this kind and in the layouts that will be the result, and this month we offer prizes in a special Layout Planning Contest.

For this contest competitors must submit a design for a layout incorporating two terminal stations, one of which must include "run-round" loops and direct access to an engine shed and a turntable. The arrangement of the other terminal station and of the line generally is left to the competitor's own judgment. An intermediate station with small goods yard also must be shown. It should be remembered that layouts will be judged on their possibilities for railway working, and not in accordance with the amount of material employed. Drawings should be to scale as far as possible.

The contest will be divided into two sections—Home and Overseas. Prizes consisting of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four best entries. A number of consolation prizes will also be awarded. A similar set of prizes will be reserved for Overseas competitors. In the case of a tie for any prize, neatness will be taken into consideration in making a final decision.

Envelopes containing entries should be clearly marked "*H.R.C. Layout Planning Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, by 30th November. Overseas closing date, 28th February, 1934. Entries received later than the published closing dates cannot be entertained.

It must be remembered that the omission of the H.R.C. number from any entry will cause it to be disqualified. This is an important condition to which members should pay special attention. Members should also take care to ensure that their name and full address is clearly written on each sheet of paper submitted, as numbers of entries are still sent in each month not bearing any name and address.

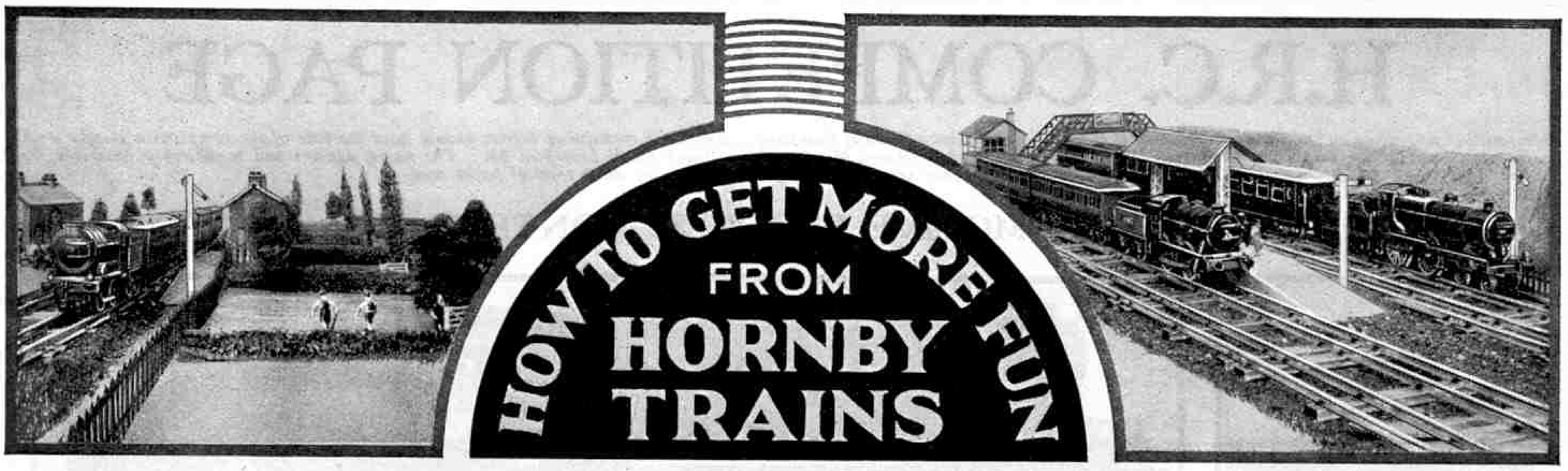
COMPETITION RESULTS

HOME

August "Fourth Name and Number Contest."—First: R. Couling (28701), Southall, Middlesex. Second: D. A. F. Quekett (3631), Belfast, Northern Ireland. Third: J. R. Fairman (29582), Southampton. Fourth: W. S. Hulton (4368), Bolton, Lancs. Consolation Prizes: H. S. G. Darke (4461), London, N.W.6; R. Burrell (27679), Streatham, London, S.W.16; H. J. Vincent (4210), Coulsdon, Surrey; J. W. C. Lowe (25627), Clacton-on-Sea, Essex; T. Middlemass (21393), Falkirk, Stirlingshire; K. J. Wallace (15121), Bromley, Kent; T. W. E. Roche (25711), Teignmouth, S. Devon; C. E. Wrayford (6039), Moretonhampstead, Devon; W. K. Tomlinson (10007), Thornton, Blackpool; W. S. Arnott (18451), Edinburgh; A. G. Rudd (26116), Bramhall, Nr. Stockport; J. M. I. Scott (29060), Kettering.

August "Railway Photo Contest."—First: D. S. Bowis (15287), Brighton. Second: A. Parminter (15981), Dawlish, Devon. Third: R. C. T. Lyle (30157), Tupsley, Hereford. Fourth: J. W. Hague (1258), Ripon, Yorks.

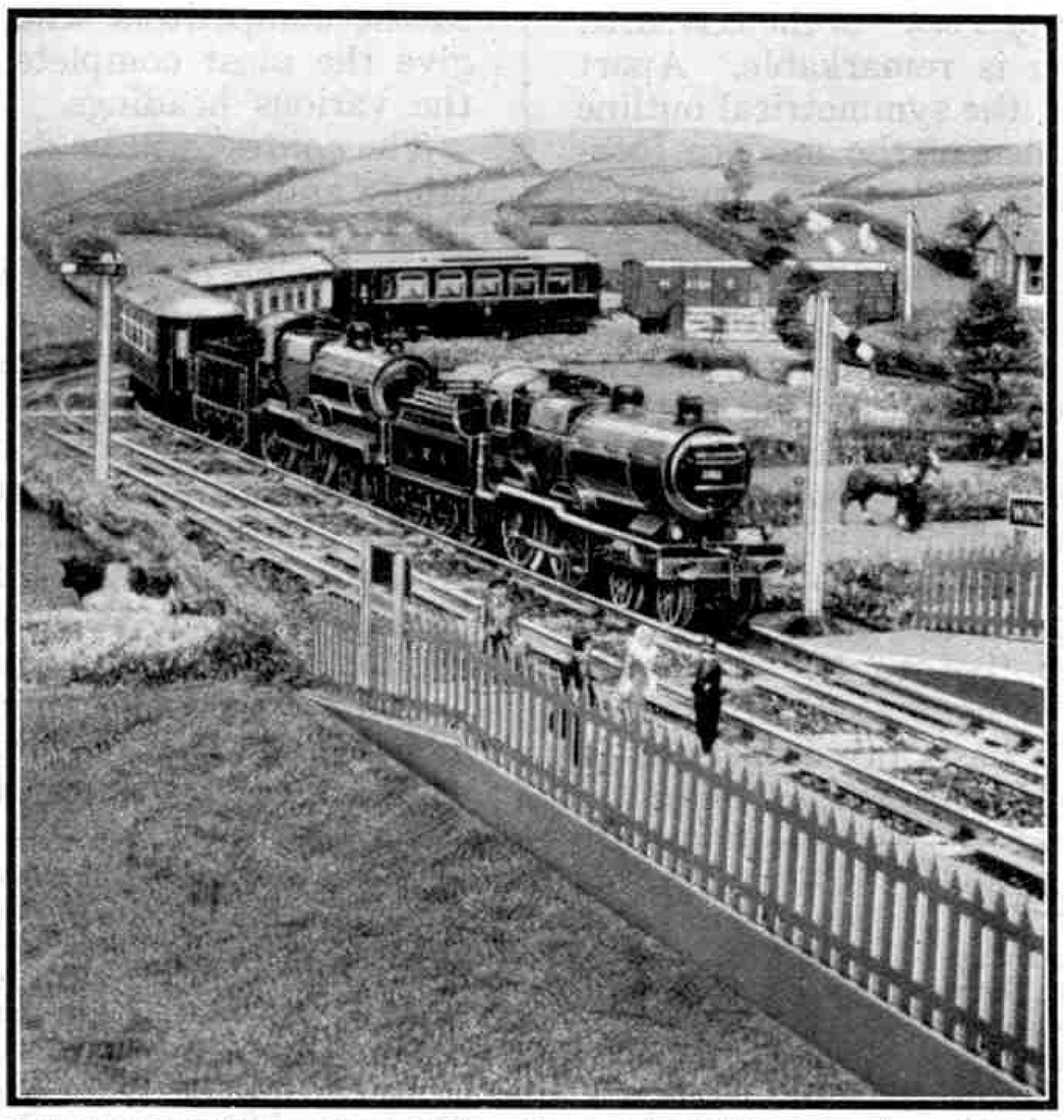
August "Railway Joke Contest."—First: Miss Dorothy Bargh (35234), Dronfield, Nr. Sheffield. Second: A. Lucking (3556), Witham, Essex. Third: D. Kidd (27421), Muirend, Glasgow. Fourth: W. P Wiseman (24776), Great Yarmouth



LXI.—MILK, PARCELS AND FISH TRAINS

RAILWAY traffic may be divided broadly into two classes, passenger and goods, and each of these is capable of being sub-divided under numerous headings. Passenger traffic implies definitely the carriage of passengers, whatever their particular classification, but certain items of goods traffic may hardly agree with the definition "goods," as usually understood. It is traffic of this character that we propose to discuss this month, with particular reference to Hornby railways.

As an example, perishable traffic, such as milk, is not strictly of goods character, and in addition such traffic may be conveyed in coaching type vehicles as part of a passenger train, or in complete trains made up exclusively of vans appropriate for the traffic. By coaching type vehicles we imply stock approximating more to coaches than ordinary wagons in their construction, such as many parcel vans and milk vans of real practice. Such vehicles are fitted with automatic brakes and steam heating connections, thus enabling them to be included without difficulty in the composition of passenger trains. This applies, therefore, to many vehicles of up-to-date construction.



A double-headed Hornby express train with vans attached in the rear for perishable traffic. The conveyance of fish, fruit, milk and similar items by passenger train frequently occurs in real practice.

An interesting development of recent years has been the introduction of special tank wagons for the conveyance of milk. Previously the only method of carrying milk by rail was in the familiar churns loaded into vans specially built for the purpose, ventilation being an essential feature. Two vans of this type are available in the Hornby Series. The Milk Traffic Van No. 1 has open-boarded sides and is provided with several churns. The Milk Traffic Van No. O also represents an open-boarded van, and is tinprinted in detail to give this impression, though the openings in the sides are not actually pierced.

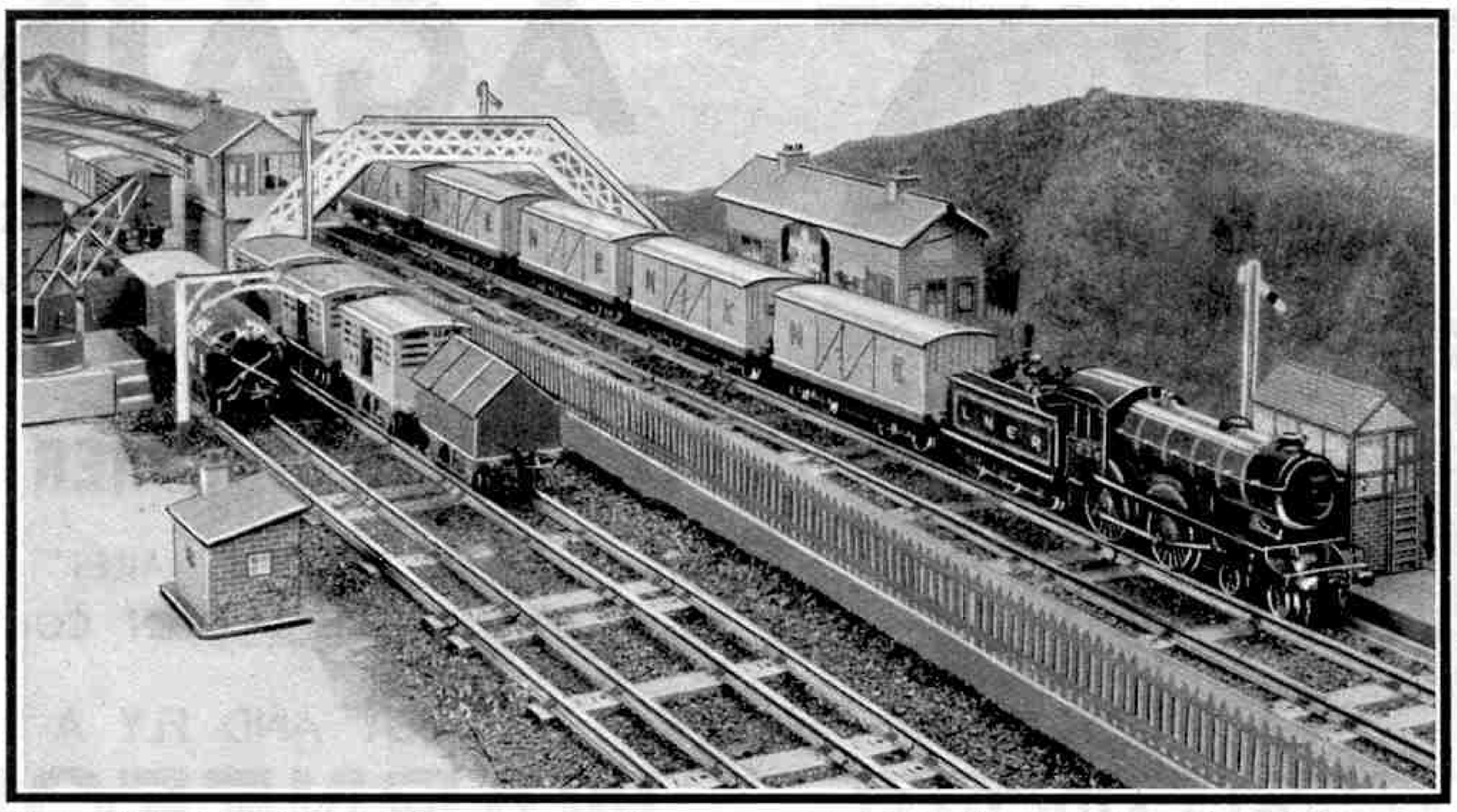
Even more attractive is the Milk Tank Wagon of the Hornby Series, introduced some time ago in order to keep pace with modern developments. The tank is of generous proportions, and the details are particularly complete. These vehicles can be used very effectively, and one of our photographs shows a realistic scene on a Hornby railway, where a complete train of them is being hauled by a No. O G.W.R. Locomotive. This represents one of the many consignments that pass daily from the Western counties up to receiving depots in London.

These tank vehicles are to be found on all the group railways. It is interesting to note that although the actual tanks belong to the various dairy firms concerned, the underframes supporting them are provided by the railway companies. Thus the same principle obtains as when churns are used—the dairy provides the receptacle for the milk, and the railway company the actual vehicle. As they have automatic brakes and steam heating connections, these milk tank wagons rank as coaching vehicles, and therefore can be attached to passenger trains when necessary. It would be interesting and unusual in miniature to see a Hornby Milk Tank Wagon included in the make-up of a passenger train. This would be a satisfactory method of dealing with the traffic where insufficient Tank Wagons are available for forming a whole train of them.

Another item that we may associate with milk, since we are used to having both of them delivered to us each day, is the newspaper. Railways play a large part in the distribution of newspapers, but as the trains concerned necessarily run in the small hours, the average person knows little of them. Some trains are devoted entirely to the conveyance of newspapers, but in other cases the vans are attached to passenger trains. There is no reason why newspaper trains should not be a feature of Hornby layouts. No special vehicles are required, for ordinary parcel and luggage vans are invariably used in actual practice. Therefore No. 1

and No. 2 Luggage Vans, and of course No. 1 Guard's Vans, may all be employed in making up a miniature "Down Newspaper," as railwaymen call it.

Some of these trains run very smartly, the L.N.E.R. 2.32 a.m. from Marylebone being a good example. This covers the distance of 22.5 miles from Leicester to Nottingham, start to stop, at 61.4 m.p.h. in 22 minutes. Running of this kind is well reproduced by clockwork locomotives, for although their total length of run may be relatively limited, their acceleration is rapid, the speed is high, and they slow down quickly, just as a real engine would do on a sharply-timed journey. This L.N.E.R. train is a regular passenger train that conveys also newspaper traffic, but we may note that the 1.40 a.m. and the 2.30 a.m. of the G.W.R. from Paddington are essentially newspaper trains, the former serving Plymouth and the West, while Bristol is the destination of the latter. Vans are detached from it for Swindon, Oxford, Gloucester and other districts.

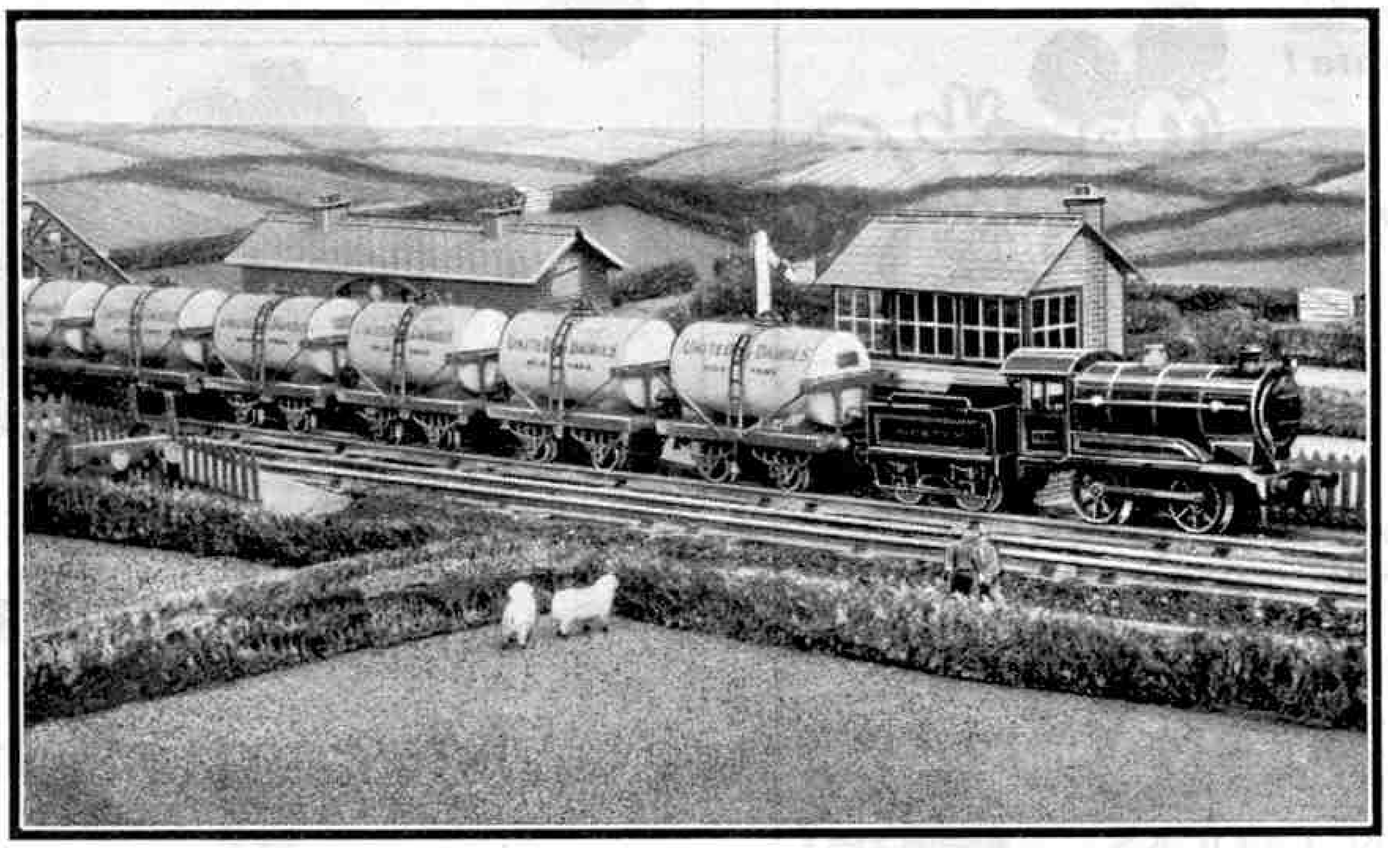


Trains of Hornby No. 2 Luggage Vans may be used for newspaper and parcels traffic in miniature. The locomotive shown in this photograph is displaying the appropriate headlamp indication for a train of this kind, composed of coaching vehicles.

Enthusiasts who are keen on conveying miniature loads may easily imitate bundles of newspapers by making up little paper parcels about $\frac{1}{2}$ in. square and $\frac{1}{4}$ in. thick, tied up with cotton or thread. Even when not being actually conveyed by rail, they will always add to the interest and realism of the station platforms. One point that should not be missed is the opportunity thus afforded for the employment of the covered motor vans of Modelled Miniatures No. 22, not only for bringing the traffic for dispatch by rail, but also for its distribution at destinations. Readers may paint and letter their standard vehicles in the styles employed by the journals and distributors they are familiar with, and the realistic aspect of the line will be much improved by such additions.

Similar rolling stock may be employed also for parcels trains, and here again miniature road vehicles may be used in connection with the railway. A great variety of packages are carried by parcel trains, so that those who make up their own luggage of this description need not confine themselves to a standard set of dimensions for them. The hampers of Railway Accessories Set No. 1 can be used with good effect here, for they are very popular for a variety of purposes, and are employed by the railways for holding numbers of smaller parcels consigned to one destination.

One of our photographs shows a fast train composed entirely of No. 2 Luggage Vans, and hauled by an L.N.E.R. Locomotive. This represents a typical parcel train in miniature. Such trains, like newspaper trains, travel by night, a condition that may be imitated by operating the line in a darkened room, with only the various accessory lights for illumination. The effect of this is novel and quite exciting.

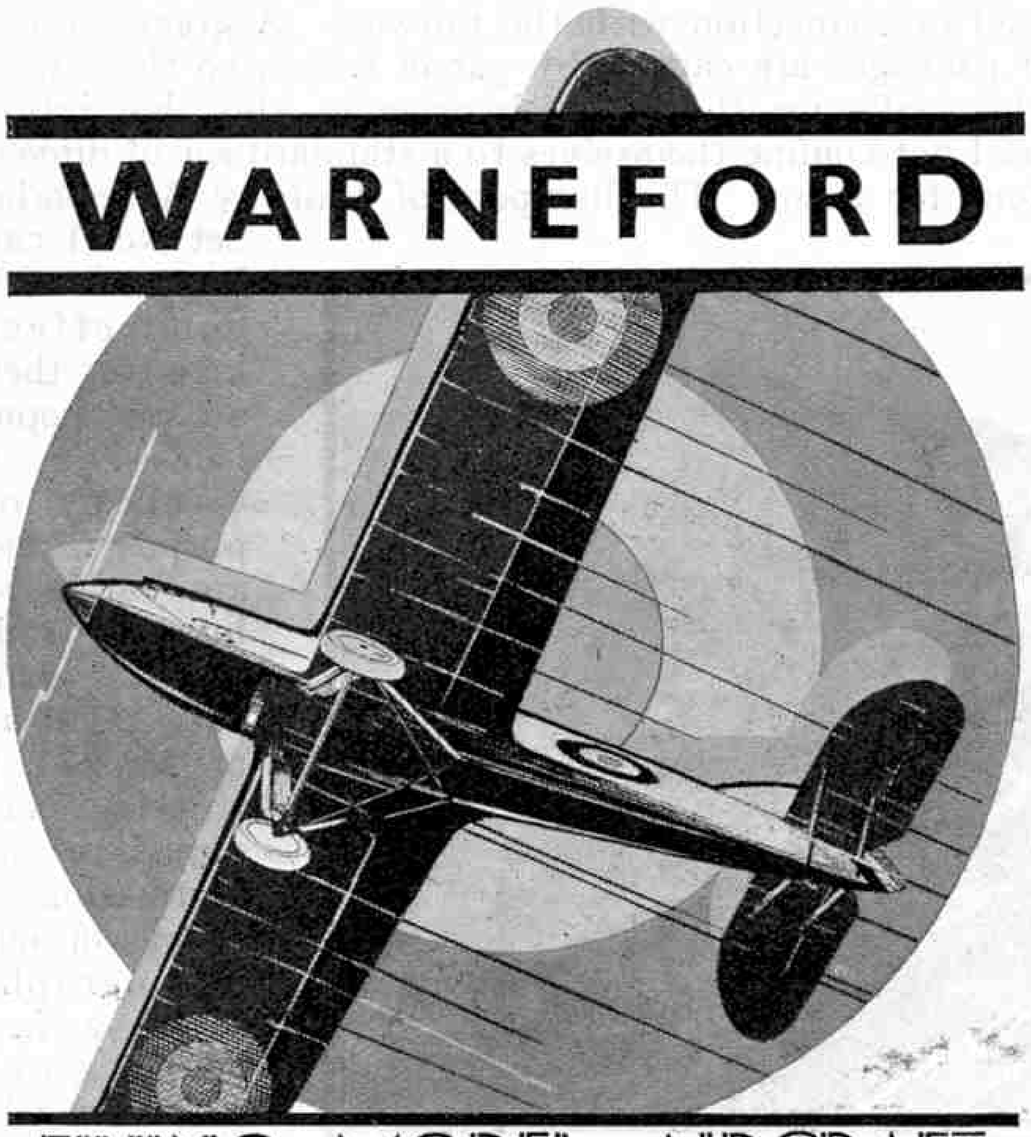


The carriage of milk is an important item in railway work. The Hornby Milk Tank Wagons enable the latest practice to be reproduced in miniature, the train shown being very effective.

Fish is a traffic that frequently needs to be conveyed by passenger trains. Possibly the "catch" has been landed late and a particular market has to be caught; or perhaps a van load is regularly required for a certain town. In either case the attachment of the vehicles required to a passenger train is the obvious course. Quite important passenger trains may have fish vans attached to them, especially those running southward from Scotland. One of our photographs shows a miniature L.M.S.R. train conveying two vans in the rear. This is a Scottish express, as is evident from the route indicator carried on the pilot engine. The "up" L.N.E.R. "*Aberdonian*" frequently includes fish vans in its make up, while their attachment to up expresses on the G.C. section is often carried out at Nottingham.

Numerous trains for fish traffic only are operated, and in many cases these run on quite fast schedules. The Hornby Fish Van is a good example of the ventilated type of van used for making up such trains.

WARNEFORD



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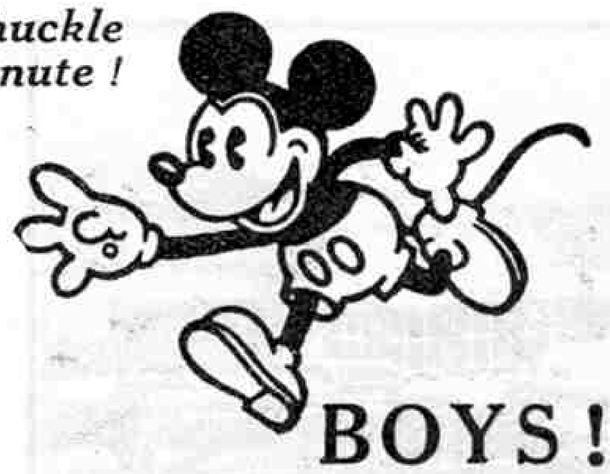

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DEANSGATE MANCHESTER

A TIP-TOP LAWYER

They were discussing a young lawyer friend.

"He's a smart fellow," said one. "He has the law at his finger-tips."

"Oh, has he?" replied the other. "That's just as well, for I'm sure he has little in his head."

* * * *

"Did you divide those three apples with your brother?"

"Yes, but as it is so awkward to divide three, I ate the odd one first."

* * * *

The tramp asked the lady of the house if she had an old coat to spare.

"But the one you are wearing is in splendid condition," she replied.

"That's just the trouble, mum," said the tramp. "It's so good that it's spoiling my profession."

* * * *

Brown walked into the office late again.

"Why don't you use your alarm clock?" asked the Chief.

"I do, sir," replied Brown, "but I no longer find it alarming."

* * * *

Little Jack, who was staying with his aunt, was trying manfully to cut his meat at dinner-time.

"Are you sure you can manage, dear?" asked Auntie.

"Yes, thank you, Auntie," replied Jack. "We often have meat as tough as this at home."

* * * *

"Don't forget to bring something for the rats," called Mrs. Williams as Mr. Williams left for town.

"Not me," he replied. "If they're not satisfied with what is in the house, they can leave."

* * * *

"It is strange," said the observant man, "but very few people are content to do what they are best qualified for. Painters, for instance, long to be musicians. Musicians long to be authors. Authors long to be artists, and so on."

"Quite," said his companion; "but there are exceptions to every rule. I know a young man who has been doing the same thing for years and years, and he seems perfectly satisfied with it."

"Oh," said the observant man, "and what has he been doing?"

"Nothing," came the reply.

* * * *

Diner: "I've been waiting half-an-hour for this turtle soup."

Waiter: "But, sir, you know how slow turtles are."

* * * *

"Children," said the schoolmistress to her class, "I want you all to write an essay on 'The Funniest Thing I Ever Saw'."

The class commenced, but one small boy managed to finish before the others. "Let me see your effort," said the teacher.

The boy produced a paper on which was written:—"The funniest thing I ever saw was too funny for words."

* * * *

Haughty Lady (after purchasing a stamp): "Must I put it on myself?"

Polite Post Office Clerk: "No, madam; on the letter."

* * * *

Clerk: "Excuse me, your worship—you can only remand him."

Newly-appointed Justice: "Very well, then. You are severely remanded."

* * * *

"What do you call a man who keeps on talking and talking when people are no longer interested."

"Please, sir, a teacher."

* * * *

"Waiter! Your finger's in my soup!"

"Don't worry, sir. It's not hot."

"WATT" A MAN!

"It's impossible to deny that young Williams is a live wire."

"That must be the reason for his shocking manners."

* * * *

"Why is midnight like the roof of a house?"

"S'late, you know!"

* * * *

Technical Terms Illustrated

Remote Control.

(Reproduced by Courtesy of the "A.E.I. News.")

"Is it far to the next village?"

"Well, it seems farther'n what it be, but it bain't."

* * * *

"Why do you insist on having the bigger share of the pudding, Henry?" asked nurse. "Isn't your elder brother entitled to it?"

"No, he isn't," replied the little fellow, "'cos he was eating pudding three years before I was born!"

* * * *

"Good morning, madam!" said the assistant in the toy department. "What can I do for you? Would your little boy like a game of ludo?"

The lady was delighted. "Oh," she exclaimed. "I'm sure he'd be very pleased, if it won't take up too much of your time."

* * * *

"William," said teacher sternly, "why haven't you a good excuse for staying away from school yesterday?"

"It isn't my fault, teacher," said the sad-looking pupil.

"It isn't your fault? what do you mean?"

"I did my best to think of a good one," he replied.

ASK THE COW!

The farmer was staying with relations in town.

"No milkman for us," he remarked to his young nephew as the tradesman called; "we have our own cows at home."

"But, Uncle," protested the nephew, "If you don't have bottles and cartons how do you know which is milk and which is cream?"

* * * *

One springtime, following a specially dry summer, a farmer planted onions and potatoes in alternate rows.

"Why are you doing that?" asked his neighbour.

"I'm not being caught by the drought this year," he replied, "for the onions can make the potatoes' eyes water and so irrigate the land."

* * * *

He had just come down from the University and felt that the world was at his feet.

"I've half a notion to work in your office, Dad," he said one day.

"Good!" replied Father. "Then I'll put you on half-pay."

* * * *

The teacher had been explaining the word coincidence.

"Can anyone tell me of a coincidence?" he asked.

"Yes, sir," replied one bright lad. "My mother and father were both married on the same day."

* * * *

The professor was deep in thought.

"What can I get for you?" asked the chemist.

"I'm trying to think what I wanted in this bottle," he said.

"Which bottle?" asked the chemist.

"Good heavens!" gasped the professor, "I've forgotten the bottle."

* * * *

A diner at a restaurant saw at another table a man he thought he had met before. He went up to the other.

"Excuse me, but are you Dunn?" he asked.

"Done!" exclaimed the other, "I've only just started."

* * * *

"Yes," said the man to an acquaintance, "John and I are in partnership, but we don't carry the same goods."

"What do you mean?" asked his friend.

"Well, John goes round selling a stove polish that leaves a stain on the fingers, and I go round the next day with the only soap that will take it off."

* * * *

Sobs were heard coming from Willie's bedroom.

"What is wrong, dear?" asked Mother.

"My night light has gone out, and I can't see whether my eyes are open or shut," came the reply.

* * * *

"Jane," said the mistress to the new maid, "when you wait at table on my guests, please don't wear any jewellery."

"Well, ma'am," replied the maid, "I have nothing of real value, but thank you all the same for the warning."

* * * *

Two actors were discussing a mutual friend.

"Yes," said one, "as an actor he was a failure; now he's become an architect."

"And he's drawing better houses, no doubt," commented the other.

* * * *

"What is your occupation?"

"It isn't an occupation, it's a pursuit. I'm a bill collector."

* * * *

"It's four years since I was in this town," remarked the stranger to the hotel waiter, as he was walking out after dinner. "It looks just the same."

"I don't find much change, either," said the waiter as he picked up the penny left on the table.

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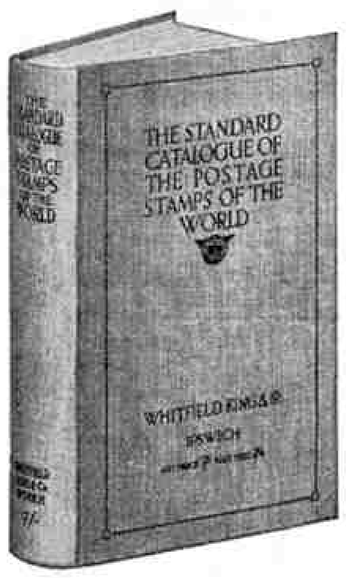

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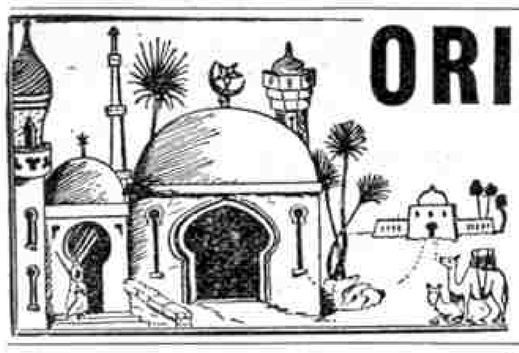

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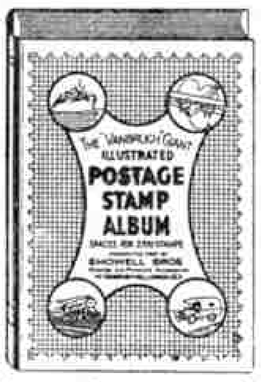

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A GREAT ELIZABETHAN ADVENTURER

The most interesting British Colonial commemorative issue of recent years has just come to hand from Newfoundland, where a special set of 14 stamps has been issued to mark the 450th anniversary of the annexation of Newfoundland by Sir Humphrey Gilbert in 1483. Beautifully produced, and possessing several uncommonly interesting designs, the set provides a fascinating life story of Gilbert, one of the most romantic figures of the stirring days of Good Queen Bess.

In describing the stamps it will be more convenient to take their chronological order rather than the ascending order of value, and in this way maintain the thread of the stamp story, which affords a good illustration of the stamp album's fascinating way of dealing with the lives of the men who made history.

Humphrey Gilbert was born at Greenaway in Devon in 1539, as nearly as can be ascertained, and his early boyhood was spent at the family home, Compton Castle, which is illustrated on the 2c. stamp. Compton stands to-day and, it is interesting to know, is still the property of the Gilbert family. Later Gilbert went to Eton College, the quadrangle and Founders' Tower of which are shown on the 4c. stamp. Eton thus achieves the distinction of being the first British public school to be featured in a stamp design.

After passing through Oxford Gilbert became a soldier, serving in France and Ireland. His courage and initiative earned quick promotion, and at the age of 30 he had become Governor of the Province of Munster. A knighthood was conferred upon him in 1570, about which time he married, but instead of retiring to the family estate as a country gentleman he conceived the idea of founding a Colony in Newfoundland. He urged Queen Elizabeth to grant him a charter for such an expedition but it was not until 1578 that the Queen consented. The ceremony at the conferment of the charter on 11th June of that year is shown on the 7c. stamp.

The letters patent were valid for only six years, but the summer of 1583 was well advanced before Gilbert's expedition set sail from Plymouth, a scene that is shown on the 6c. stamp.

There were five vessels, the flagship "*Delight*" (120 tons), the "*Raleigh* (provided by Sir Walter Raleigh, Gilbert's half-brother), the "*Golden Hind*" (40 tons), the "*Swallow*" (40 tons), and the "*Squirrel*" (10 tons). A picture of the good luck token—a miniature anchor—received by Gilbert on the eve of sailing from Raleigh on the Queen's behalf, is shown on the 5c. value.

The "*Raleigh*" soon returned to port, but the other vessels, after having been separated by storms for the greater part of the voyage, reached St. Johns early in August, the "*Squirrel*" being the first to arrive. The 9c. stamp shows the arrival of the flagship on 3rd August, with two welcoming figures from the "*Squirrel*" in the foreground.

Two days later Gilbert carried out a formal annexation, at which ceremony one of the original settlers handed him a piece of turf for acceptance in the name of the Queen, an incident that is depicted on the 10c. stamp. The 14c. value is allied to this event, for surrounding the Royal Arms in the design is an important extract from Gilbert's report of the ceremony sent to the Queen: "I have engraven there the Arms of England."

A week or so later Gilbert set out in the "*Squirrel*," accompanied by the "*Delight*" and the "*Golden Hind*," upon an inspection of the coastline. The 20c. stamp shows an old map of Newfoundland, which is specially interesting in that the North is at the bottom and the South at the top. This is one of the best produced stamps of the whole series, and all the place names on the map may be read very easily with the aid of a magnifying glass.

Gilbert's coastal expedition was the beginning of the end. On 29th August the "*Delight*" went ashore and foundered, and the weather became so bad that Gilbert decided not to return to St. Johns to pick up the "*Swallow*," but to make sail direct to England. On 2nd September he paid his last visit to the "*Golden Hind*," and his friends beseeched him vainly not to return to the tiny "*Squirrel*," the "cockleshell," as they termed it.

The final episode is best described in an extract from a well-known biography. "On September 9th in the afternoon, after emerging from a storm to the south of the Azores, Gilbert was seen sitting abaft the "*Squirrel*" with a book in his hand; as often as he came within hearing distance of the "*Hind*" he was heard to utter 'We are as near to Heaven by sea as we are by land.' At midnight the watch on board the "*Golden Horn*" observing the lights of the "*Squirrel*" to disappear suddenly, cried out 'The general was cast away,' which was true, for in that moment the frigate was destroyed and swallowed up in the sea."

The scene of the early afternoon, with Gilbert sitting quietly on the "*Squirrel's*" poop, is shown on the 15c. stamp, with an inscription of the words of comfort that Gilbert uttered to his crew.

There remain to be described four designs, and of these the 24c. is particularly interesting. It is a portrait of Queen Elizabeth—her first appearance on a stamp. The 1c. stamp bears a portrait of Sir Humphrey Gilbert himself, taken from a print published in 1620, and on the 3c. there is shown the Gilbert Coat of Arms, a squirrel *sejant*, a shield featuring three roses of the field on a chevron *gules*, and the motto "Quid Non"—Why Not. The 32c. stamp shows the statue of Sir Humphrey in its niche over the South Porch of Truro Cathedral.

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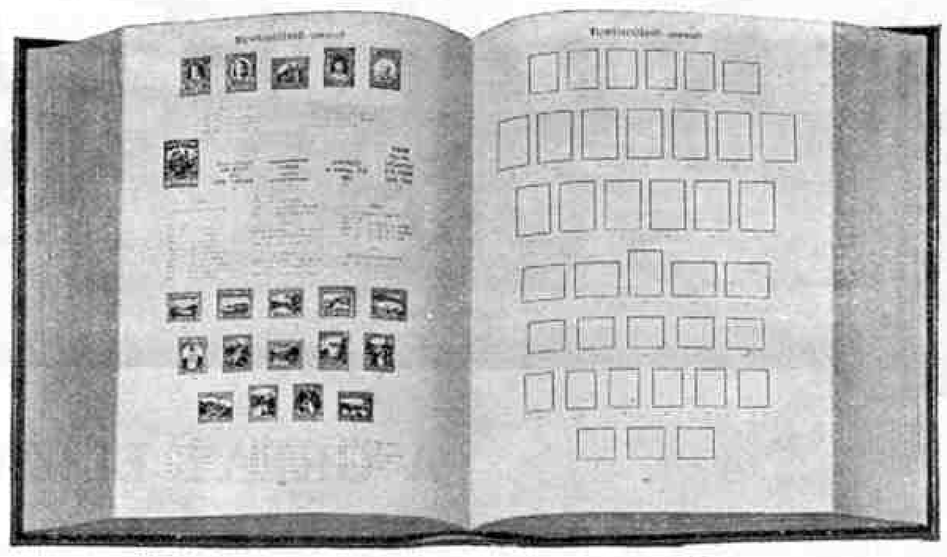

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NEW SECOND VOLUME BRINGS IT RIGHT UP-TO-DATE

The original "Imperial" (now known as Vol. I) caters for all British Empire stamps from 1840 to mid-1928. Now we have "Imperial" Album Vol. II, which brings the Album right up-to-date and makes Vol. I absolutely permanent. Your stamps, once in Vol. I, need never be moved.

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A separate space for every British Empire stamp. Squares are on one side of the page and are numbered to correspond with an illustrated catalogue opposite. These artistically arranged squares are slightly smaller than the actual stamps and therefore do not show when the latter are in place.

PRICES : Edition with Strong and Handsome Grained Cloth Binding. Leaves are of tough white paper from which hinges peel without trace.

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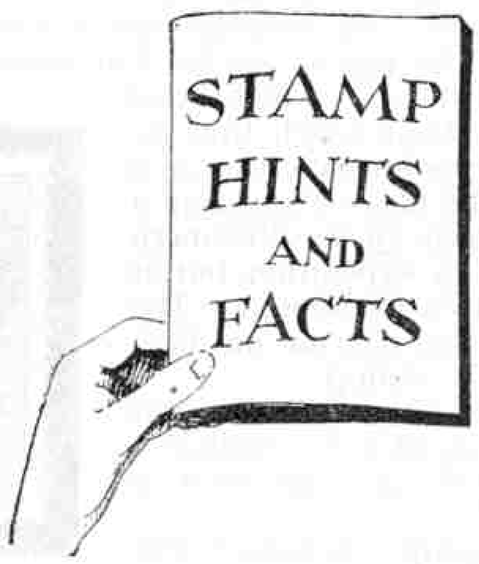

FREE!
A NEW BOOK

STAMP HINTS AND FACTS—a new Stanley Gibbons booklet which will tell the young collector many interesting things about his hobby. It will be sent free to all asking for a sheet of the world-famous Stanley Gibbons Approvals. Let us know the countries or groups you would like to see.

Just as a suggestion, there is Sheet FQ, the new Air Stamp sheet.

Remember that the Winged Triangle appears on all Stanley Gibbons Window Packets, Stamp Albums, etc. Look for it when buying your stamp goods locally and don't take those without it.

Look for this Sign Always

STANLEY GIBBONS LTD.
DEPT. S.15, 391 STRAND, LONDON, W.C.2

Stamp Gossip

and Notes on New Issues

The Gibbons' 1934 Catalogue

A year or two ago we likened the stamp collector working without a catalogue to a mariner without a compass. If we may again adopt a maritime simile, we would describe the 1934 Gibbons' catalogue as the collector's pilot, for it guides the serious stamp enthusiast through the pitfalls of the more advanced sides of his hobby.

Its 2,000 pages provide not only a priced list detailing every stamp issued, each with its important varieties, but also full-sized illustrations and details of all designs, watermarks, perforations, surcharges, the names of the designers and printers, the type of paper, and the printing process employed.

It is difficult for the outsider to conceive the huge amount of work involved in the preparation of so comprehensive a catalogue, but some idea of the task can be gained from the fact that this year over 200,000 separate prices have had to be checked and more than 20,000 of them altered. Gibbons' Catalogue has come to be the accepted basis of stamp exchange throughout the British Empire, a distinction of which its publishers are proud and a responsibility to which they pay due regard.

This is not a catalogue for the beginner in stamp collecting, but definitely it is an essential to the collector who takes his stamps seriously. As usual, it is obtainable in two sections dealing with the British Empire, and the Rest of the World respectively; or in one complete volume, containing both sections. The catalogue may be obtained from any stamp dealer, price 6/6 for the British Empire Section or 10/– for the Rest of the World Section. For the complete volume, bound in handsome royal blue binding, gilt lettered, the price is 15/–.

An Interesting Postmark

A special postmark was used to frank correspondence originating in Tokio between 25th and 28th April last. It was employed in connection with a service of intercession, held at the Yasukuni Shrine, for the Japanese soldiers who were killed in the recent Sino-Japanese war. In addition to a representation of the shrine, the design of the postmark embodied an aeroplane and an army tank.

Canada's Postal Union Commemorative

It is perhaps a little late in the day to feature a commemorative issue that appeared as long ago as June, but Canada's 5c. issue celebrating the meeting at Ottawa of the Executive of the Postal Union is so excellent a stamp that it is better to show it late than not at all. It is one of the most attractive of the several excellent Canadian pictorials of recent years.

The view is a new one of the Parliament Buildings at Ottawa shown from the Ottawa River. The beauty of the engraving gives an excellent impression of the well-wooded slopes of Parliament Hill.

Another exceedingly attractive 5c. stamp has been issued to celebrate the centenary of the first Atlantic crossing by steamboat. The central design of this stamp shows a view of the steamer "*Royal William*" ploughing its way through heavy seas in the course of its crossing. Beneath, the name of the ship is flanked by the centenniel dates 1833–1933. The colour of this stamp, blue, greatly enhances the beauty of its design.

British Successes in Vienna

Britain scored many triumphs at the recent Philatelic Exhibition in Vienna, to which reference was made in our Stamp Gossip in the August "*M.M.*" The International Grand Prix, equivalent to the World's Philatelic Championship, was awarded to Mr. J. B. Seymour for his specialised collection of the stamps of Great Britain. The *WIPA* Grand Prix, the second most important award, was gained by Mr. J. H. Curle, for his collection of Transvaal stamps. In all, British exhibits gained nearly 90 important awards.

We are particularly pleased to note the success of our advertisers, Stanley Gibbons Ltd. in the Trade and Literary Sections. In competition with all the leading European stamp firms, they were awarded eight medals for their exhibits of stamp collecting equipment. The well-known Royal Blue, Utile, Simplex, Criterion, Strand, Ideal and Atlas Stamp Albums, judged as one group, secured a silver medal, the highest award allotted to any albums. Similar prizes were awarded to Gibbons' Stamp Monthly and to the Gibbons' Catalogue. Mr. Stanley Phillips, of Gibbons, received a silver medal for his book "Stamp Collecting."

New Hungarian Issues

Among the new issues we illustrate this month, Hungary's International Scout Jamboree commemorative issue is of special interest, although its very attractive design seems to have no direct connection with the Scout Movement.

The issue comprises five stamps, 10f. to 40f. values, and the design illustrated here was used for them all. It shows a stag, a depiction of a legendary creature that is reputed to have guided the forefathers of the Hungarian race, Hunor and Magor, to the fair provinces of Hungary. The stag is shown leaping over three small mounds upon one of which is mounted an apostolic cross.

Hungary also has issued a new air series to replace the old issue of 1927. There are nine values covered by four designs, and the best of these is undoubtedly the 10c. illustrated here. It shows the Lockheed Vega machine "*Justice for Hungary*" that made the trans-Atlantic crossing in July last year piloted by the late Gyorgy Endresz and Sandor Magyari. The machine is shown flying over the St. Endre Island in the Danube.

The "*Justice for Hungary*" crashed at Rome not long after its trans-Atlantic flight, and was replaced by a new machine presented by Signor Mussolini. This machine, named "*Giustizia per l'Ungheria*," is illustrated on the 20f. and 40f. stamps of the new issue. The third design, used on the 48f. and 72f. issues is allegorical and shows Mercury posing on the wings of a low wing monoplane, while in the remaining values, 1p., 2p. and 5p., he stands with arms outflung across a huge four-bladed propeller.

* * * *

Malta shortly is to issue a series of air mail stamps. The watermark in the general issue is to be changed also. Although Malta is a self-governing unit of the Empire, it has used the Crown Colony watermark hitherto.

* * * *

In our next issue we hope to illustrate the Irish Free State Holy Year Commemorative issue. The design is the best I.F.S. commemorative to date.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

? PHILATELISTS

ARE YOU SATISFIED WITH YOUR COLLECTION ? Of course not. No real stamp collector is ever fully satisfied with his collection. It is possible however to bring a collection very near perfection and become the envy and admiration of all your chums. That is why we are bringing to your notice the cheapest possible method of quickly enhancing the value of your collection by investing in the

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100 all diff. stamps ... ... **1/3** post free. A wonderful variety of stamps.

200 ALL DIFF. STAMPS, 2/6 post free. This packet will prove to be the forerunner of many happy hours spent amidst your collection.

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1,000 ALL DIFF. STAMPS, 20/– post free. Nothing quite like this has ever before been offered. Stamps catalogued at several times the price of the packet will be discovered. In value it is a sheer **revelation** and is a packet that will increase the monetary and educational quality of a collection beyond your wildest dreams.

Do not delay therefore in sending off at once for one of these marvellous collections.

Every stamp is carefully examined by experts before entering a packet, and there is our additional guarantee of complete satisfaction or money refunded in full.

Will our friends abroad please add 6d. to the above packets to cover extra postage, registration, etc.

COSMOS PHILATELIC EXCHANGE,
254, Kentish Town Road, London, N.W.5, England.

SEND 1½d.

postage for the best and cheapest advertised Approvals. Thousands of hinge-mounted spacefiller bargains available in 2 or 3 postings only. Meccano Readers amazed at the value and vast variety. Also with Lists, etc., we shall include entirely FREE.

FOR

you, a grand set of **25 Bavaria** (Ludwigs) or **5 Iceland** (National Museum, etc.) or **103** diff. including **Syria, Lebanon, Alaouites,** or a pkt. of Hinges and two diff. **2d. Sydney Bridge(s).** STATE WHICH. Further along with the above we shall send you full details of our huge

125,000 STAMPS

FREE ! gift scheme. Send 1½d. only. Overseas 3d. Mystery parcel 5,000 approx. unsorted Stamps, **4/6.** Overseas, **5/3.**

ASTLEY & CO. (M.22),
LOW HILL, WOLVERHAMPTON.

SCARCE MANCHUKUO PACKET FREE ! ! This huge parcel contains **500 Unsorted Foreign Stamps,** many scarce, from **Manchukuo** (Lama Pagoda), Old Japan, 1899, Ceylon, Egypt, Q.V., over 50 years old, Br. S. Africa, **Finland,** etc. Send 2d. postage and request my **Famous Discount Approvals.** (Abroad 6d. P.O.).
E. EASTICK, 22, BANKSIDE ROAD, BOURNEMOUTH.

GIVEN AWAY £2 EVERY MONTH

to purchasers from our world-famed approval Sheets. Send for approval sheets and full particulars to Department 229. *Established 1880.*
ERRINGTON & MARTIN, South Hackney, London, E.9.
Those sending a stamped addressed envelope will receive free three handsome Pictorial new issues.

2/6 Boxes — Average 1,000 Stamps — 2/6 Post Free

You should try one of these boxes of well assorted UNPICKED Mixtures which are made up from stamps as received from Banks, Shipping Houses, Foreign Missions, etc. Countries represented: Jamaica, China, Japan, Dutch Indies, West Indian Isles, Czecho-Slovakia, Straits Setts., Russia, Poland, New Zealand, West and South African Colonies and many others too numerous to mention. New and old issues with high values. The repeat orders I have had prove their excellent value.
JOS. H. GAZE, DIDSBURY, MANCHESTER.

Boys! Get this Album!

Ask for the "XLCR" Stamp Album, a bonny illustrated robust album to hold over 2,000 stamps. 100 pages complete with index. British-made, too, and only 6d. Don't accept any other album until you see it. Insist on "XLCR" Albums, Stamp Outfits and packets. If any difficulty write to :—
Thomas Cliffe, Colwyn Bay..

only 6d.

Cayman Islands Centenary

FREE set of this fine Centenary issue to all Collectors sending for Approvals and enclosing 1½d. stamp for postage. (No stamps sent abroad.) **COLONIALS, PICTORIALS AND AIR MAILS** at bargain prices.

C. H. SHAW (Dept. M),
95, Christchurch Avenue, Kenton, Harrow.

HUNGARY AIRMAIL, 1927/30. 6 vars.	...	1/3
TURKEY, pictorials, 1926. 13 vars. ...	...	1/–
HOLLAND, William the Silent. 4 vars.	...	6d.
HOLLAND, Lifeboat Stamps. 4 vars.	...	9d.
NEWFOUNDLAND, Jan. 1932. 5 vars.	...	6d.
AUSTRALIA, 3d. Sydney Bridge, blue	...	4d.
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All fine used. Postage 1½d. extra.
Any ONE set HALF PRICE to Approval Applicants.
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THE DENTIST SAID—

"I'll fill those spaces." Why not fill those in your album from my 4-a-penny selections, the best there are.

L. D. MAYNARD
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TRIANGULAR PACKET FREE!

This wonderful packet contains a **Mint Triangular Iceland Airmail** (Icelandic Falcon), **Triangular Fiume** (Steamboat), and 20 other interesting stamps including **Commemorative** Issues from **Italy** (**Fascisti** and **Founding of Rome**), **Cochin, Ukraine** (two large mint pictorials), a large Mint Airmail, **Charkari** (pictorial), **Johore** (bi-coloured), **Nicaragua** (**One Peso Mint**), also mint High Values, British and French Colonials, etc.
FREE to all genuine Approval Applicants enclosing 2d.
C. A. REISS (Dept. M), 1, CASTLE GARTH, KENDAL.

NEWFOUNDLAND — SPECIAL PICTORIAL ISSUE

A new set of Stamps from Britain's oldest Possession sent free of charge to bona-fide applicants for selections of duplicates on approval.
500 extra good Stamps, all different, 1/8.
MYSTERY PACKET. 1,000 (approximately) stamps, many countries, unpicked and just as collected from abroad. Post free 1/3.
HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

I WILL SEND YOU 1,000 DIFFERENT STAMPS

on approval, from which you may select any 100 for **3/–**. These Stamps are **EXCELLENT VALUE** and include some catalogued at 1/– each or more.
MORE ADVANCED Collectors are invited to send for better class selection on approval, priced at one-fifth to one-third Catalogue.

H. HARDY,
6, Birchington Road, Hornsey, London, N.8.

GREATEST BARGAIN PACKET!

1,000 Stamps as supplied from London offices, etc., contains stamps of Kenya, Uganda, Egypt, New Zealand and Australia, and many other countries. **NO** unused German, etc. Many rare Stamps are found in this mixture. **FREE** with every order **the Rare Piccard Balloon Stamp and Handsome Air Mail,** usually sold at 7/6. But to introduce my new price list of sets, etc., I will supply the above for **2/–** P.O. Half lot **1/3** post free. Send at once for this marvellous offer to
W. F. LOVELL, 96, Gosterwood Street, Deptford, S.E.8.

MANCHUKUO PACKET FREE

A fine packet of all different Stamps containing **Manchukuo,** 1932 ½ fen pictorial, **French Indo China Air Mail,** unused, **Eritrea,** 1930 2c., large pictorial **Somali Coast, Tunis** 1933, new issue, **Turkey** pictorial, **Brazil** pictorial, **Nigeria, Portugal, Ceylon,** etc., free to all asking to see my famous Approval Sheets and enclosing **2d. for postage (Abroad 6d. P.O.).**

Albums, **1/4, 2/6, 5/–** and upwards.
S. HAMMOND, CHESHAM FIELDS, BURY, LANCS.

SPECIAL SERVICE OF NEW STAMPS

To readers of "M.M." joining my Service before Dec. 31st, 1933 (reasonable extension granted to overseas enquiries) entitles them to enter for a **COMPETITION** to be organised in connection with this Service. Handsome awards will be made. Full particulars will be announced in the New Year. Ask for details.

T. H. SMITH,
63, St. Kilda Road, West Ealing, W.13.

FREE GIFTS

How to obtain

A STAMP ALBUM FREE

Write for particulars and
44-PAGE BUMPER BARGAIN LIST
D. A. BERRY, Member British Philatelic Assn.,
19, CORPORATION STREET, MANCHESTER.

NEW MODEL APPROVAL BOOKS

Good, Clean, Medium Stamps, Price One Penny each. BUT
30 for 2/– 60 for 3/– 120 for 4/9
240 „ 7/– 360 „ 9/– 480 „ 10/6
THE MORE YOU BUY THE CHEAPER THEY ARE. 5 U.S.A. Commemoratives are presented FREE to new customers.
EDWARD SANDELL,
10, EVELYN GROVE, SOUTHALL, MIDDLX.

NEWFOUNDLAND—

Sir Humphrey Gilbert Commemorative Stamps will remain on sale only five months, and should be obtained NOW as they will doubtless prove an excellent investment. We offer the complete mint set of 15 Stamps (1–32c.) for **7/6**, or set to 10c. (9 Stamps) for **2/6**, POSTAGE EXTRA. The **1933 Air Stamps** (set of 5) are also available (mint) at **9/–** the set. Send 2d. for our detailed price list of **Canada and Newfoundland** Stamps.
NORRIS & CO. (Dept. M), NORWOOD, LONDON, S.E.19

YOUR CHANCE !

The finest value ever offered in real bargain Approvals. Thousands different on sheets at ¼d., ½d., and 1d. each. Fine range in books from 1½d. to 2/6. Prices average ⅛th Gibbons. Write now for a pleasant surprise! State "Wants."

CAMPBELL
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TREASURE TROVE

Send to-day for one of our Bargain Parcels of 1,000 Unpicked Stamps and commence one of the most enjoyable searches you have ever had. The Stamps are gathered from all parts of the World and are unsorted. Many scarce Stamps can be found in the mixture, and it will be sure to add a large number of specimens to your collection.

Price 1/– per packet of 1,000 (Postage 3d. extra).
HEWSON & SAYWELL, ABINGDON-ON-THAMES.

NOT A FREE GIFT ! Send me 4d., ask for selection from 4 a 1d. (30 for 6d.) and I will send you Newfoundland (Gilbert Centy.), Afghanistan, Trans. Jordan, Angola, Monaco, Ethiopia, Manchukuo, Guinea, and 25 Colonial and Foreign without Approvals, 6d.
J. R. MORRIS, 9, Audley Road, Folkestone, Kent.

FREE! 7 GREECE pictorials (1927)

To Genuine Applicants for my "Peak" Approvals.
S. BACKHOUSE, 61, WARNER STREET, DERBY.

"MAJESTIC" STAMP OUTFIT FREE

Also **LIBERIA PACKET** of 51 different Stamps to all genuine applicants for my world famous Approvals. Send 2d. Postage. Abroad 4d.
M. WILKINSON, Majestic Buildings, Colwyn Bay.

Locomotive Jig-Saw Puzzles

An intriguing range of Jig-Saw Puzzles representing engines of the principal Railway Companies of Great Britain has just been issued by our advertisers, Fredk. Warne & Co. Ltd. Each of the puzzles consists of 200 pieces and will provide fascinating amusement for a whole evening for any reader. The puzzles are selling at 5/– each, and further details can be obtained from Fredk. Warne & Co. Ltd., Chandos House, Bedford Court, Bedford Street, Strand, London, W.C.2.

"MECCANO MAGAZINE" BINDERS

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/– post free. Meccano Ltd., Binns Road, Liverpool 13.

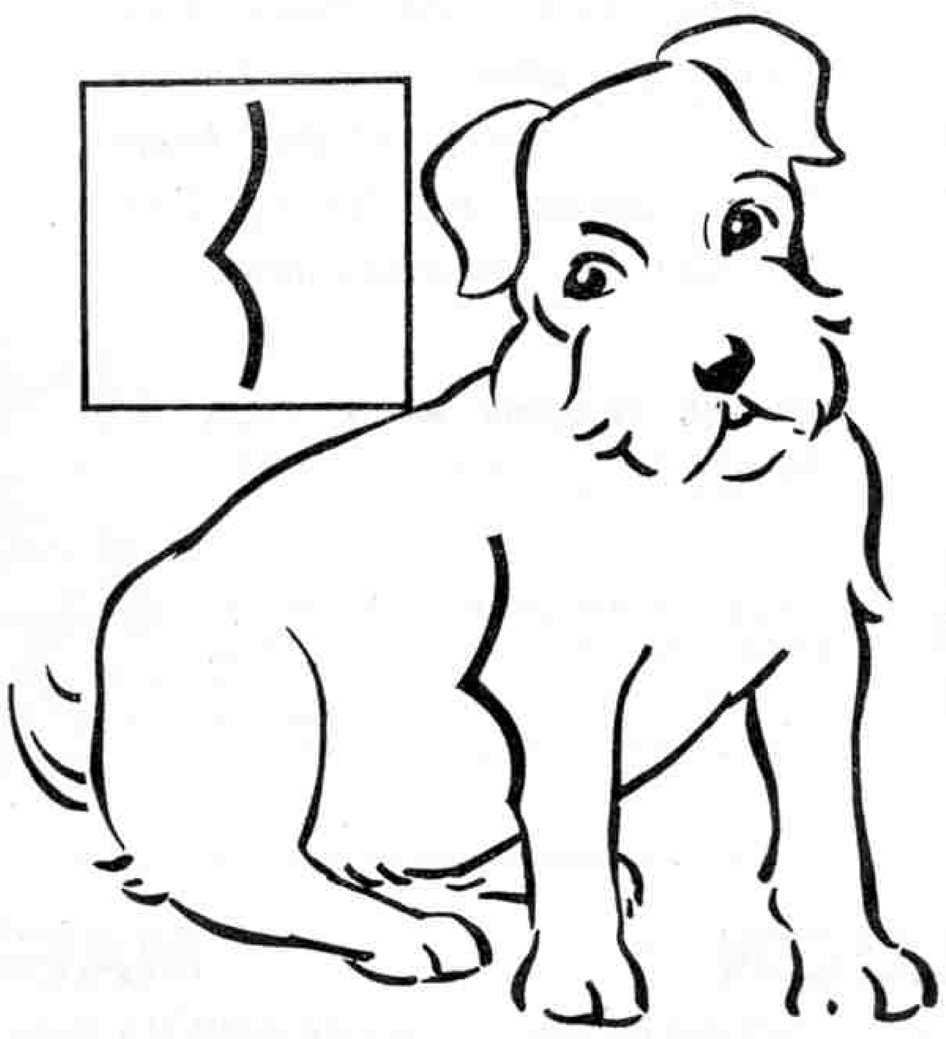
Further stamp advertisements continued on page 928

Competition Corner

A SKETCHOGRAM CONTEST

It is almost 18 months since our last Sketchogram Contest, and readers will welcome the opportunity to try their hands once more at this fascinating though simple form of drawing contest.

For the benefit of new readers it must be explained that the contest calls for no greater artistic skill than the ability to include a given line—known as the Sketchogram—in a simple sketch. In this month's contest the "Sketchogram" is the wriggly line shown in the box resting on the dog's back, and competitors are required to incorporate the line in an original sketch in such a manner that it forms an essential part of the outline. To make this explanation perfectly clear, our artist has used the Sketchogram in drawing the dog. It forms part of the rear line of the dog's right foreleg.



Readers are asked to submit original sketches in which the line is used in a similar way. It may appear in the sketch as many times as the competitor desires, and may be tilted to any angle, or turned on its back, as required. The drawing of the dog must not be copied, of course, but there are no other restrictions as to the subject or nature of the drawing.

Competitors who succeed in incorporating the "Sketchogram" more than once will be given credit for the effort, but a bold and simple drawing in which it appears only once and is immediately obvious, will stand a better chance of success than a complicated drawing in which it appears several times merely as a minor feature.

In order that our younger readers may have a fairer chance of success, the entries will be divided into two sections, A for readers aged 16 and over, B for those under 16. Two prizes consisting of Meccano products (or, if the winners prefer, artists' materials) to the value of 21/– and 10/6 respectively, will be awarded in each section. In addition there will be a number of consolation prizes.

A similar set of prizes will be awarded under exactly the same conditions for Overseas entries.

Each competitor may submit as many entries as he wishes, but each one must be sent in on a separate sheet of paper. The competitor's name, age and address must appear on the back of each entry. It is not sufficient merely to indicate the section; the exact age must be stated.

Entries must be addressed to "Sketchograms, Meccano Magazine," Binns Road, Liverpool 13," and in the Home Section must reach this office not later than 30th November. The final date for receiving Overseas entries is 28th February, 1934.

Best Bargain Contest

This month's issue of the "*M.M.*" is full of interesting advertisements and there are many bargains to be "spotted."

It would be interesting to know what our readers consider to be the best bargain, and prizes are offered for the best letters indicating the best bargain and the reader's reason for the selection.

The prizes will consist of Meccano products, to be chosen by the winners from the current catalogue, to the value of 21/–, 15/–, 10/6 and 5/– respectively, for the best four letters in order of merit.

The letters must not exceed 250 words in length, and should be addressed to "Advertisement Letter, Meccano Magazine, Binns Road, Liverpool 13." They should reach this office not later than 30th November.

A similar set of prizes will be reserved for entries from Overseas readers, whose entries must arrive not later than 28th February, 1934.

Entries must be written only on one side of each sheet of paper used.

COMPETITION RESULTS

HOME

Holiday Cruise Errors.—1. R. H. Lennie (York); 2. D. Woodward (Stockport); 3. K. N. Smartt (Chesterfield); 4. A. E. Clark (Plaistow, E.13). Consolation Prizes: S. Hutchinson (Liverpool); N. E. John (West Bromwich); F. A. Lawley (Cradley); K. Pemberton (Cleveleys); J. Sanders (Norwich); L. J. Slater (Portsmouth).

Tall Stories.—1. R. Clarke (Mansfield Woodhouse); 2. N. Sneddon (Strete); 3. H. Everitt (Streatham, S.W.16); 4. A. E. Stapleton (Derby). Consolation Prizes: J. Gilbey (Wakefield); J. Long (Downend); G. A. Price (Halesowen); D. Swan (Winchester); W. Whitaker (Hornsea).

August Photo Contest.—First Prizes: Section A, F. H. Culverhouse (Sheffield); Section B, P. M. S. Hedgeland (Maidstone). Second Prizes: Section A, A. P. Gardner (Kettering); Section B, C. H. Clary (London, E.14). Consolation Prizes: R. J. S. Booty (Sydenham); P. T. Clarke (East Sheen, S.W.14); D. E. Cooper (Witham); H. Holt (Stretford); W. M. Hunter (Lewisham, S.E.13); A. H. Karamelli (Golders Green, N.W.11).

Point Words.—1. I. G. Macleod (Gillingham); 2. A. L. Beattie (Sydenham, S.E.26); 3. I. C. A. Napper (Canterbury); 4. D. W. Robson (Chesterfield); Consolation Prizes: W. B. Acheson (Portadown); J. Duncan (Aldershot); R. F. Nicholas (Portsmouth); G. A. Roberts (Stratton-St.-Margaret); H. Rutter (Consett); R. D. Smith (Epsom).

September Photo Contest.—First Prizes: Section A, W. J. Aitken (Edinburgh); Section B, D. Kingcome (Plymouth). Second Prizes: Section A, J. L. Rice (Northampton); Section B, W. J. R. Peacock (Cheltenham). Consolation Prizes: G. Clifton (Norwich); F. H. Culverhouse (Sheffield); G. T. Espley (Preston); A. Gulliver (Beckenham); V. Knill (Thorpe Bay); J. B. Pinnock (Bedford); D. C. Rooke (Goodmayes); F. Smith (Darlington); G. H. Wood (Halifax).

OVERSEAS

May Doublets Contest.—1. W. R. L. Chegwyn (Johannesburg); 2. D. H. Patterson (Natal); 3. R. Burbery (Lyttelton, N.Z.); 4. G. S. Cotton (Wellington, N.Z.). Consolation Prizes: P. Watson (Hong Kong).

June Crossword.—1. H. A. Cripwell (Selukwe); 2. G. E. Harrison (Victoria, B.C.); 3. J. Friendly (Johannesburg); 4. D. E. de la Hoyde (Nagpur, India). Consolation Prizes: D. A. Hickman (Prince William, N.B.); A. G. Hoal (Pretoria); D. Marsden (Naboomspruit); G. Rogers (Fort Beaufort, C.P.).

June Photo.—First Prizes: Section A, J. Credie (Observatory); Section B, T. N. Lewis (Auckland, N.Z.). Second Prizes: Section A, L. A. Seton (Montreal West); Section B, R. L. Mason (Toronto). Consolation Prize: A. A. Boult (Auckland, N.Z.).

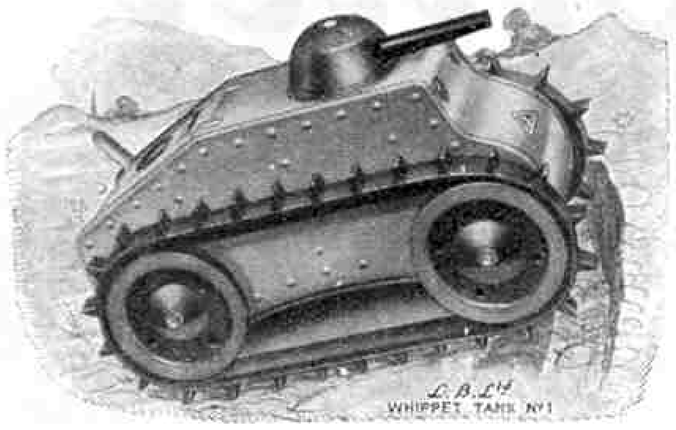
April Crossword.—1. MacL. Morgan (Cremorne, N.S.W.); 2. E. L. Meek (Wellington); 3. D. G. Tees (Durban); 4. D. Carden (Transvaal). Consolation Prizes: W. S. Eagle (Bombay); G. L. East (New Plymouth); E. Harper (Cambridge, C.P.); R. M. Maynard (Pretoria).

May Photo.—First Prizes: Section A, A. A. Boult (Auckland); Section B, R. N. Jones (Sydney, N.S.W.). Second Prizes: Section A, C. J. McCain (Sydney, N.S.W.); Section B, J. A. Rundle (Christchurch). Consolation Prizes: Miss M. Bedlington (Auckland); J. Credie (Observatory); V. Souccar (Alexandria)

TRI-ANG

(REGD. TRADE MARK)

POWERFUL CLOCKWORK TOYS



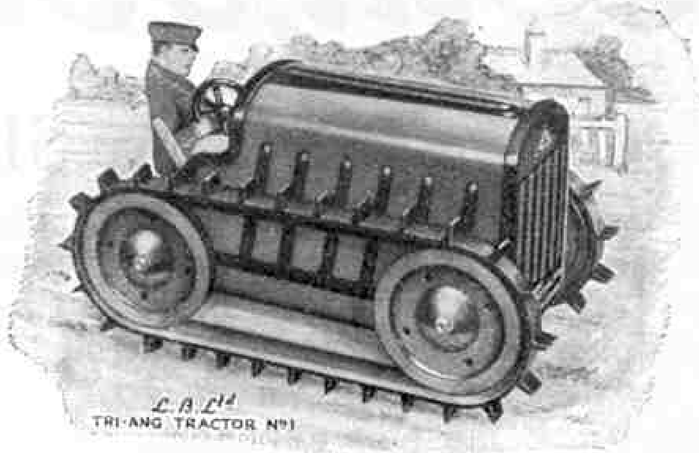
"WHIPPET" CLIMBING TANK

No. 1 - - - - - - - - - - 6d.

A miniature of a climbing fighting tank. Strong motor, control lever. Swivelling gun turret. Rubber bands. Length, 5¼ ins.

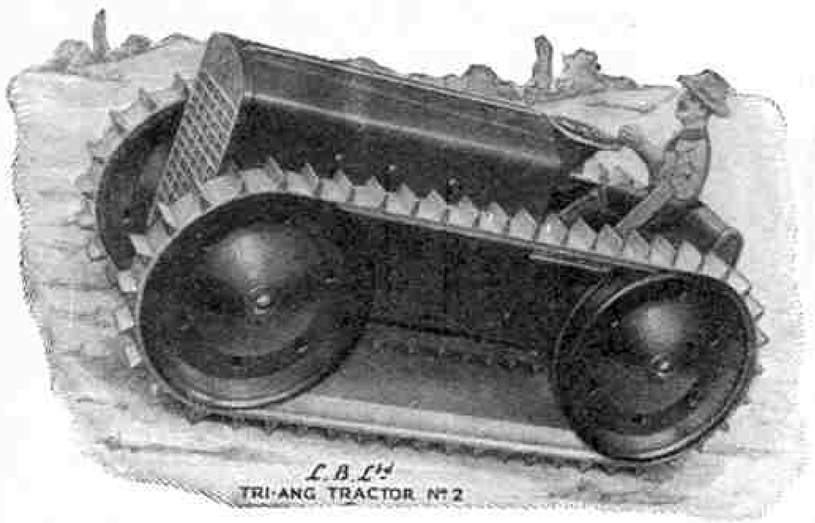
ALL STEEL BODIES

A fine new range of clockwork toys to work with your models. Real precision jobs, British made—Tractors, Tanks, and Motor Cars. There are other models besides those shown here, including Magic Sports, Saloon, and Racing Cars. Get full particulars now.



TRI-ANG TRACTOR No. 1 (Nippy) - 6d.

Climbs obstacles in a surprising way. Thick rubber bands. Control lever. Length, 5¼ ins.



TRI-ANG TRACTOR No. 2 - 2/6

Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. Length, 8½ ins.

TIGER CLIMBING AND FIGHTING TANK No. 2 - - - - - 4/11

A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever. Length, 10 ins.

MAGIC SALOON

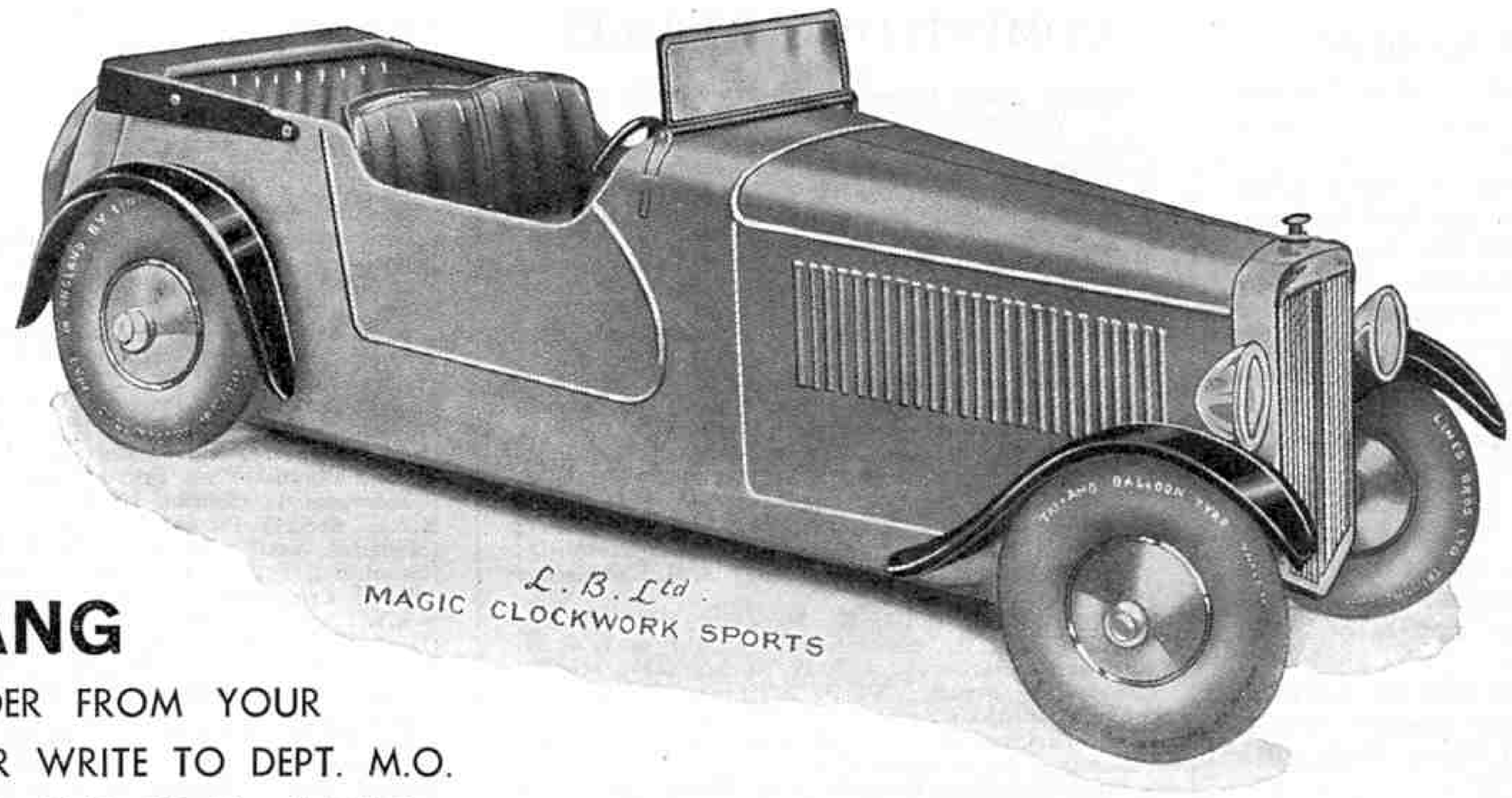
This closed car is designed in the latest low built style and has very graceful lines. Strong steel body, sports mudguards, spare wheel and tyre. Rubber balloon tyres on steel wheels. Long running clockwork motor fitted with control lever and patent governor to prevent the wheels racing when lifted off the ground. MOTOR TYPE STEERING BY WHEEL IN DRIVING SEAT. Length, 16 ins. Price **12'6**

Also made with two electric lights and switch on dashboard. (Battery not included.) Price **16'-**

MAGIC SPORTS

A scale model of a modern 4-seater Sports Car. Strong steel body, adjustable windscreen, sports mudguard, spare wheel and tyre. Rubber balloon tyres on steel wheels. Long running clockwork motor fitted with control lever and patent governor to prevent the wheels racing when lifted off the ground. MOTOR TYPE STEERING BY WHEEL IN DRIVING SEAT. Length, 16 ins. Price **12'6**

Also made with two electric lights and switch on dashboard. (Battery not included.) Price **16'-**



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Hamleys News

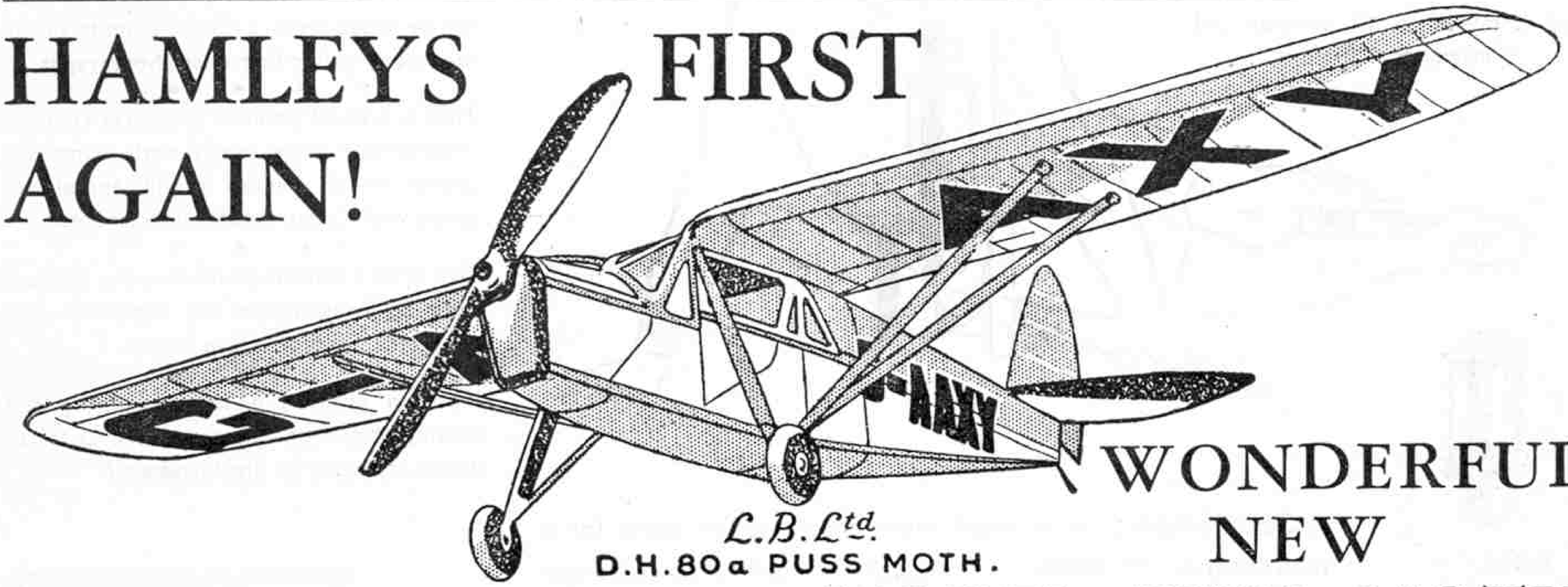
Estd 1760

·HAMLEY·BROTHERS·LTD

(Special Models and Games Supplement)

Number 7. *November*, 1933.

HAMLEYS FIRST AGAIN!



L.B.L^td.
D.H.80a PUSS MOTH.

WONDERFUL NEW MODEL PUSS MOTH

flies 600 ft. at single winding

Two spare motors supplied free

Two spare motors supplied free . . From Hamleys you can now get a "Frog" model of the record breaking D.H. 80A Puss Moth Civil Aeroplane. It has an all-metal fuselage with reinforced bulk-head, and an entirely new method of wing construction prevents warping.

PRECISION BUILT

Specially designed and built tools ensure meticulous accuracy in the production of this magnificent flying model. It has two very strong elastic motors coupled to a dual gearbox. The rudder is adjustable. All main parts have "Frog" patent detachable fittings. The model D.H. 80A PUSS MOTH has a wing span of 18", flies 600 feet at a winding and 100 feet high and is finished in light blue and orange and *costs only* 17/6 (postage 9d.) complete with 2 spare motors, gearbox oil, elastic lubricant and insertor rod and "FROG" Lubricant.

SEND FOR YOURS THIS WEEK

HAVE YOU TRIED YOUR SKILL AT BOLO?

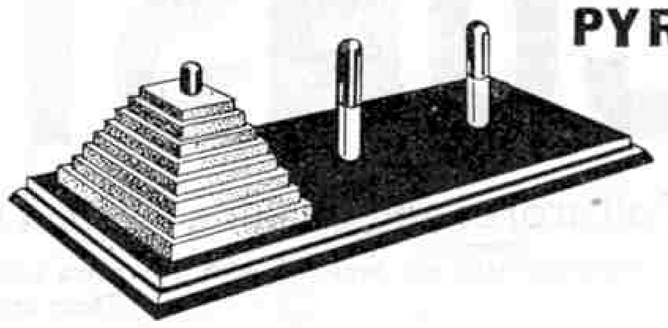
The latest,
most fascinating craze.

You can't leave it alone till you've mastered it. And when you've mastered it—my, what fun!

Model No. 1.
12 in. diameter, complete with 3 balls. 2/- (Post 6d. extra).

Model No. 2.
16 in. diameter, complete with 5 balls. 3/- (Post 6d. extra).

A NOVEL GAME WITH ENDLESS TRICKS.



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You can't be bored with this tantalising game in the house. It's always fresh, always good company. Price 2/6 (post 6d.).

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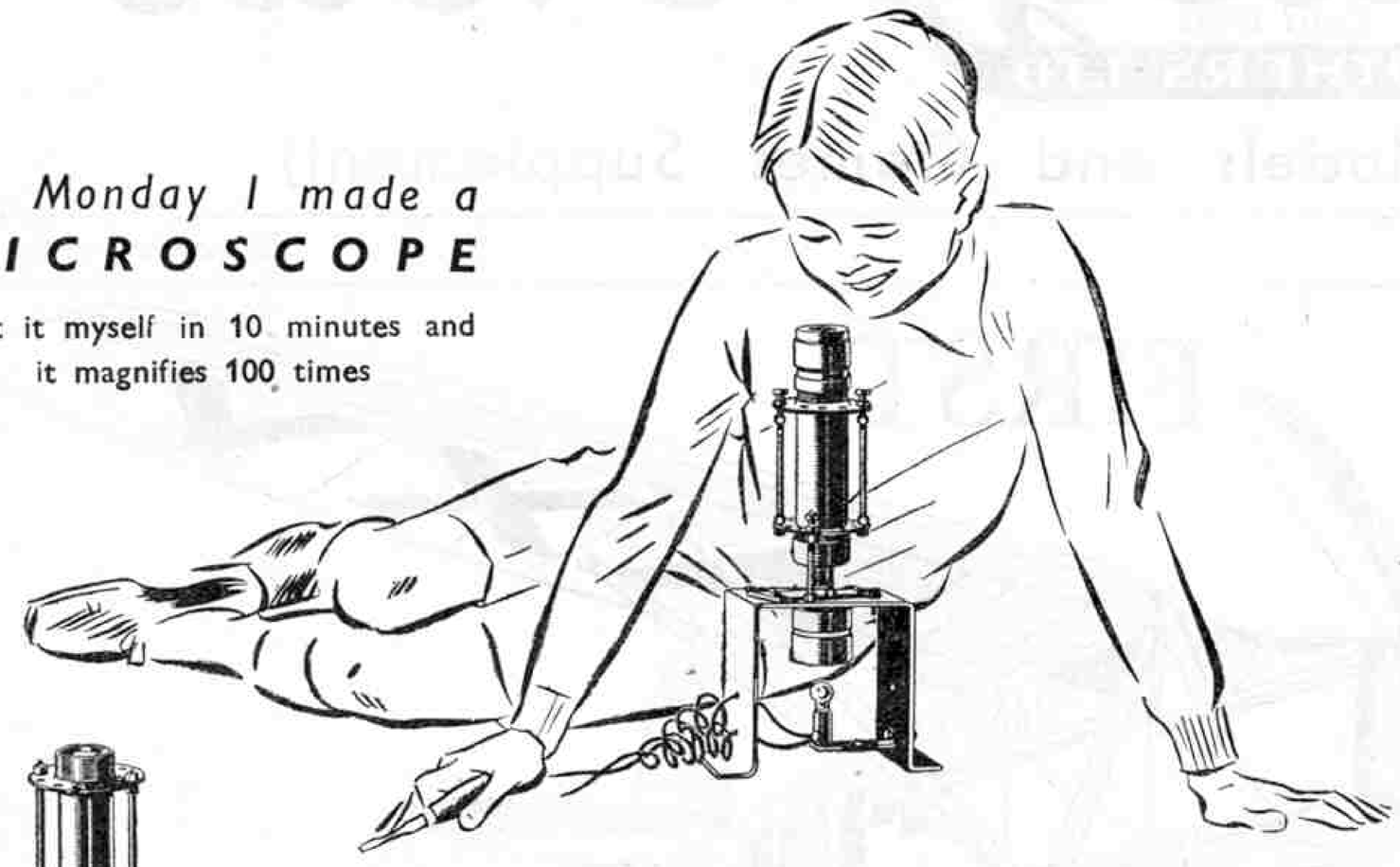
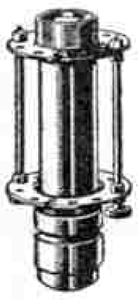
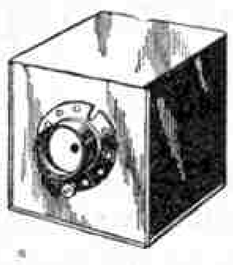
HOW MANY HAIRS ON A BEE'S LEG?



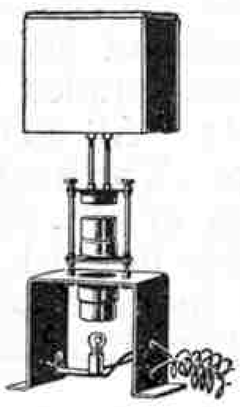
On Monday I made a
MICROSCOPE
Built it myself in 10 minutes and it magnifies 100 times



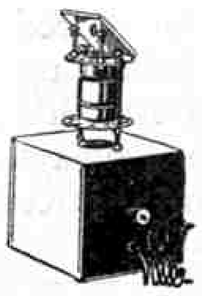
On Tuesday a
TELESCOPE



On Wednesday a
CAMERA



On Thursday a
MAGIC LANTERN



And on Friday a
MICRO-PROJECTOR

A Construments set is much more than a set of parts for a microscope. It consists of beautifully finished interchangeable parts—lenses, mirrors, ring mounts, bolts and nuts, tubes and rods—all made and matched on scientific lines. From them you can build an endless array of optical instruments. How many hairs on a bee's leg? A microscope made from Construments will show you. How is a long distance camera made? Build one with Construments and see. How does a Camera Obscura work? With Construments you can build the very apparatus a great scientist would use for a hundred fascinating experiments. Have you ever longed for a telescope—a projector—a microscope—a magic lantern—a camera obscura—a shadowscope—a projection Kaleidoscope—a photo-copier—you can make any of these and more than a hundred other instruments with a Construments set.

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A dogfish has teeth all over its body? Plainly seen with a Construments microscope.

• • •

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• • •

That a drop of pond or sea water contains innumerable living things, both plants and animals, which you can magnify and photograph with Construments instruments?

• • •

That with a Construments live-box you can examine living insects and organisms—you can watch a spider weave its web?

• • •

You can produce pictures of living and moving objects on a screen with a Construments projector or shadowscope?

And you can make hundreds of different models with

CONSTRUMENTS

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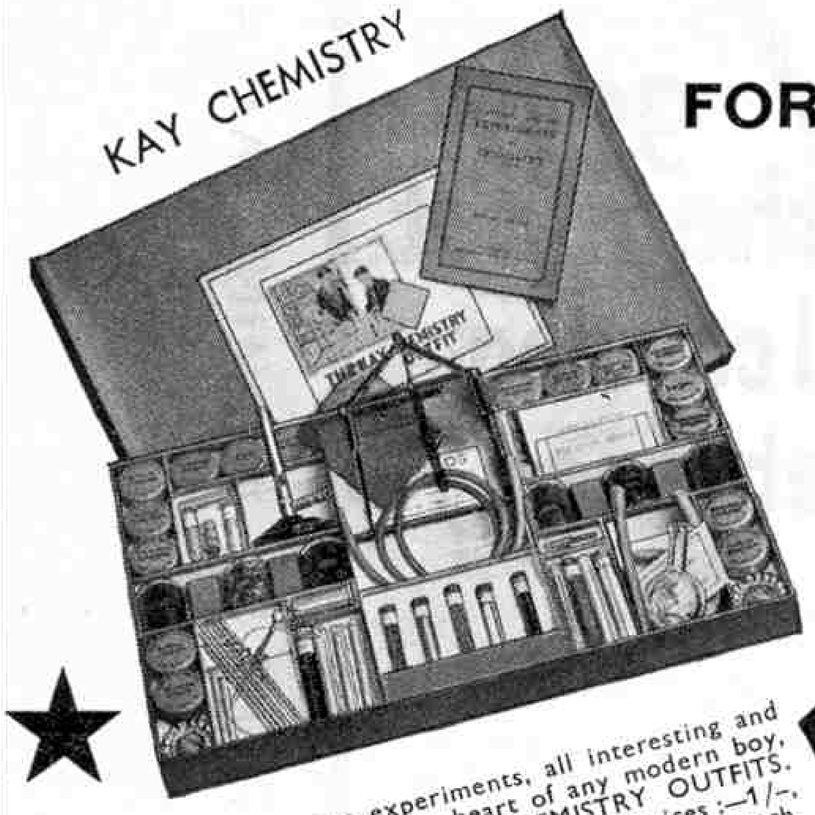

FOR THE WILL THE

BOY WHO HAVE BEST!

KAY

KAY ELECTRICAL

Thousands of different experiments, all interesting and intriguing, certain to delight the heart of any modern boy, can be performed with the KAY CHEMISTRY OUTFITS. There are splendid outfits for students at all prices :—1/–, 2/6, 3/6, 5/–, 7/6, 10/6, 15/–, 21/–, 35/–, and 63/– each, and every set above 2/6 each contains a Bunsen Burner.

In the 10/6 outfit illustrated above there are 34 different Chemicals, Bunsen Burner and Rubber Tubing, Tripod and Gauze, Flask, Test-Tubes, Glass Tubing, Filters, Asbestos Paper and Millboard, Test Tube Holder, Test Tube Brush, Trays, Scoop, Corks, and a splendid Book full of experiments and instructions.

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In the 10/6 outfit, illustrated above, there are 3 Bulb Holders, 3 Fancy Shades, 3 Bulbs, a Double-Coil Electric Bell, Bell Push, Battery Tester, Turnscrew, Switch, a wonderful Electric Induction Coil, Battery Clips, Insulated Staples, Bell Wire, Twin Flex, a tin of Kay Insulating Tape, and a splendid Book full of experiments and instructions.

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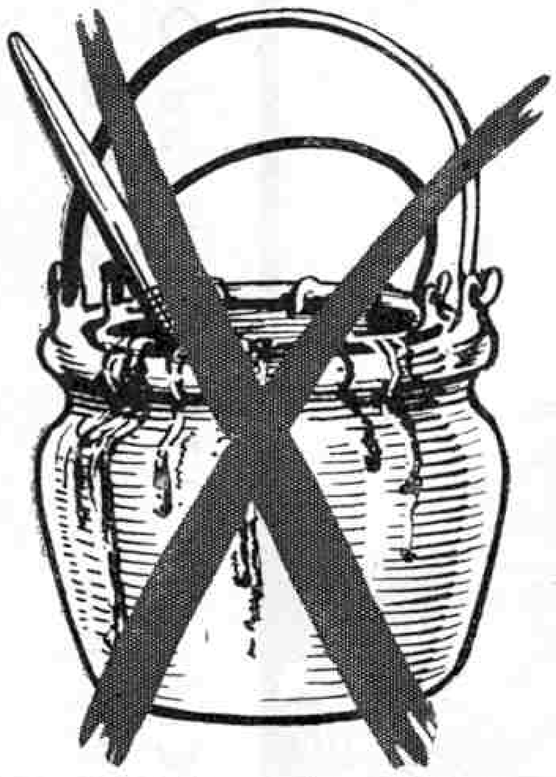
Send for FREE Illustrated Catalogue.



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Used by the Admiralty, Air Force, Aeroplane Manufacturers, etc.

Only very little is needed

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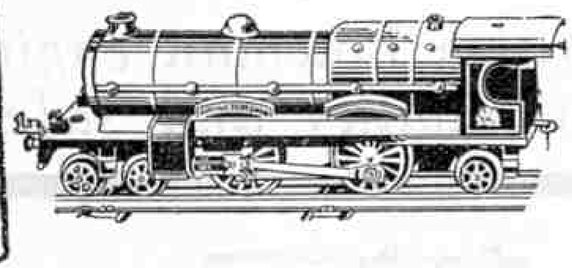

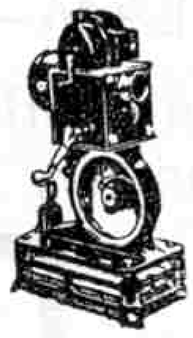

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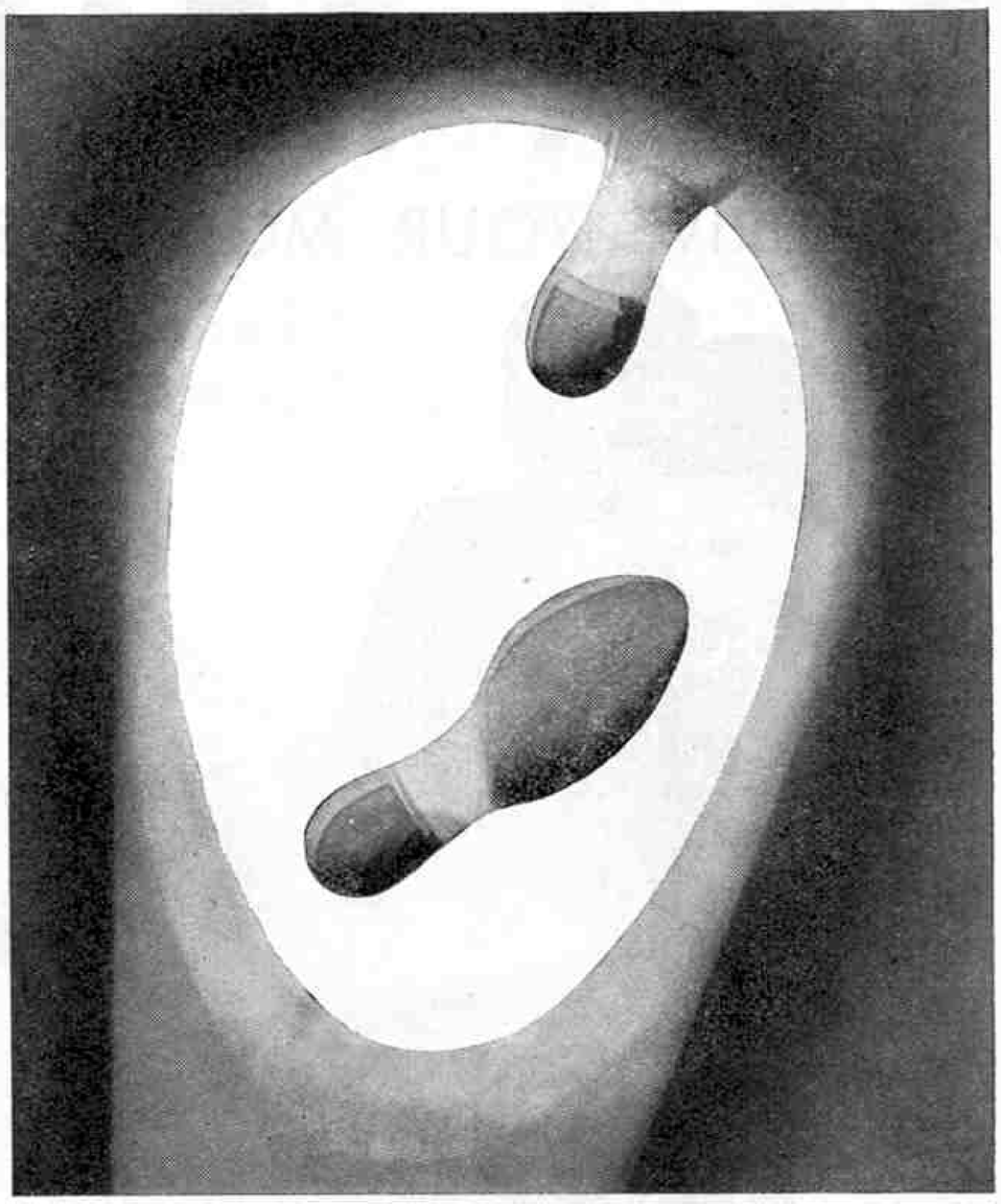

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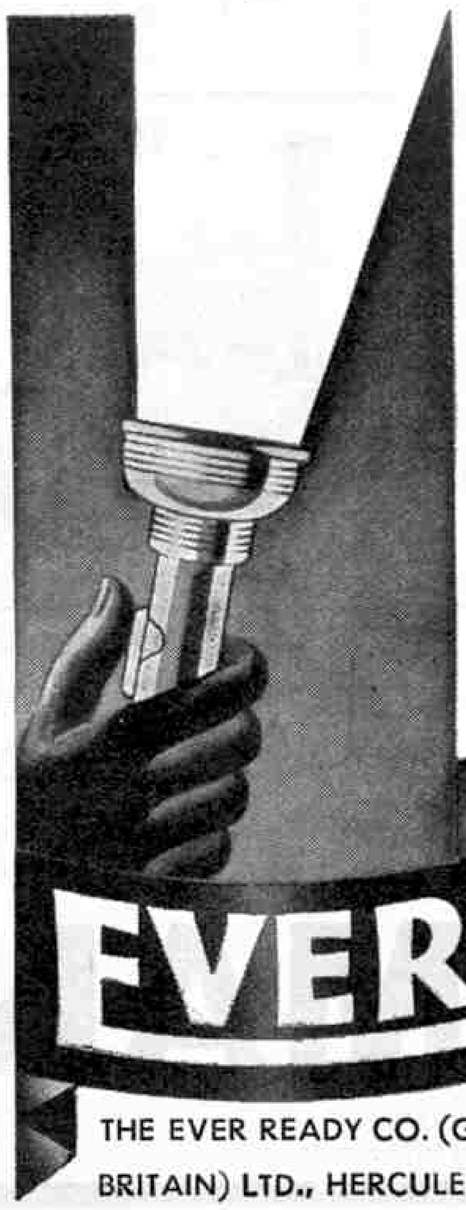

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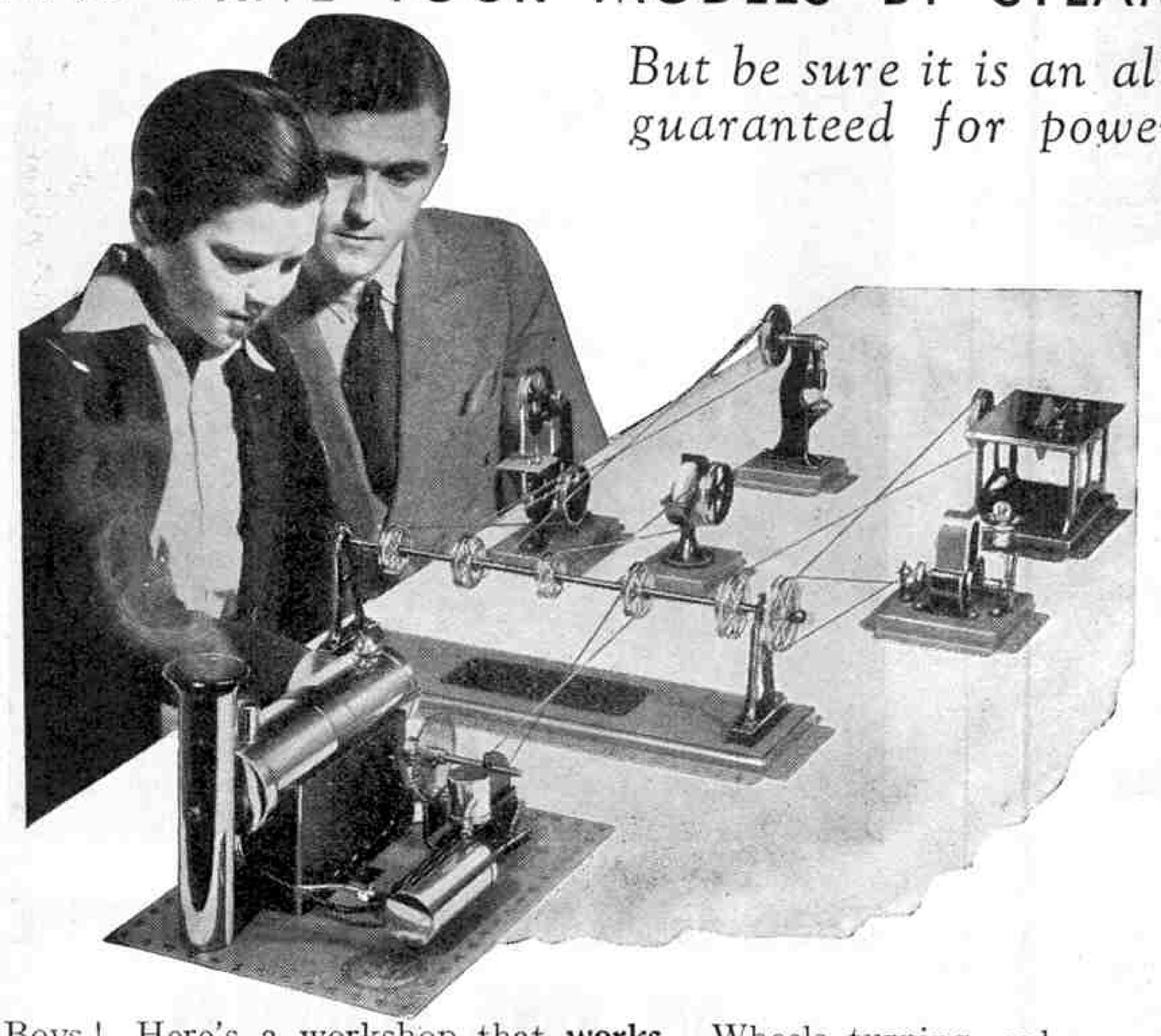
But be sure it is an all-British Bowman engine guaranteed for power, reliability and safety

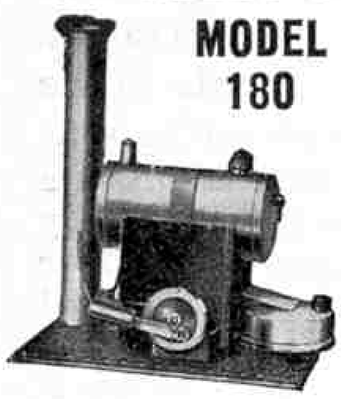


Boys! Here's a workshop that **works.** Wheels turning, axles spinning, machinery in motion—all driven by a splendid steam power plant which will touch 2,000 revs. a minute.
There's endless fun in a Bowman workshop. Start one to-day! You can keep on adding extra models as you go along.

STATIONARY STEAM ENGINE (M135) Brass boiler, $5\frac{3}{4}'' \times 1\frac{3}{4}''$, with safety valve. 2-speed gear and two driving pulleys. Drip feed lubricator. Steam exhaust through chimney. Drilled metal base. Meccano pattern by permission. In box. Postage U.K. 1/–. Price **16/9**

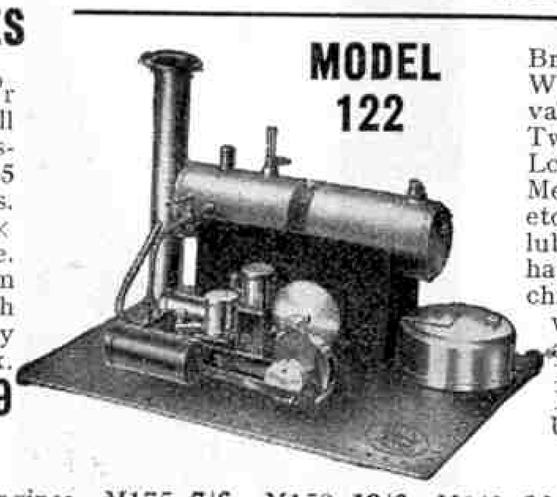
STATIONARY STEAM ENGINES

MODEL 180



A Bowman junior engine which will give every satisfaction. Runs for 15 to 20 minutes. Brass boiler, $3\frac{1}{4}'' \times 1\frac{3}{4}''$. Safety valve. Drilled base, steam exhausts through chimney. Fully guaranteed. In box. Postage U.K. 9d. Price **6/9**

MODEL 122



Brass boiler, $7'' \times 2''$. Whistle, safety valve, control tap. Two-speed gear. Low gear takes Meccano pulleys, etc. Drip feed lubricators. Exhaust through chimney. In box, with filling funnel and instructions. Fully guaranteed. Postage, Price U.K. 1/– **27/6**

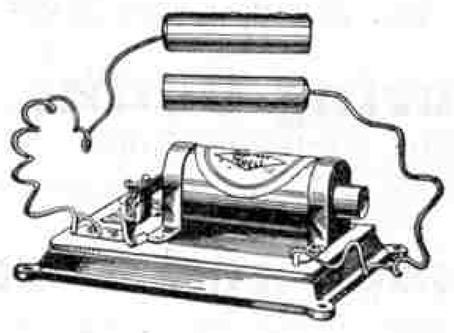
There are also four other Bowman Steam Engines—M175, **7/6**; M158, **12/6**; M140, **14/6**; M101, **37/6.**

PRESS (Model 832) **3/3** **CIRCULAR SAW** (Model 833) **3/9**
BANDSAW (Model 834) **3/11** **GRINDSTONE** (Model 835) **2/9**
DYNAMO (Model 839) **7/6** (All working models postage 4d. extra)

LOCO 234 (without tender) **30/-**

Runs $1\frac{1}{2}$ miles non-stop. Solid drawn brass boiler. Safety valve. Exhaust through chimney, 2 cylinders. Steel frame. Length with tender 20″.

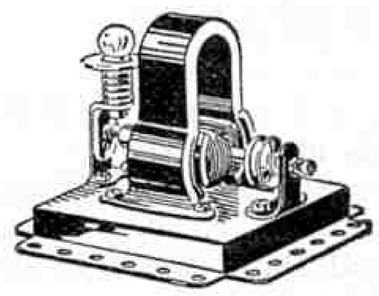
Other steam locos **10/6, 21/–, 25/–** Tender **7/6**



INDUCTION COILS

Astounding value. Polished bakelite box with variable current. Works from 4-volt battery or Dynamo. **3/6**

Dual coil model **5/–**

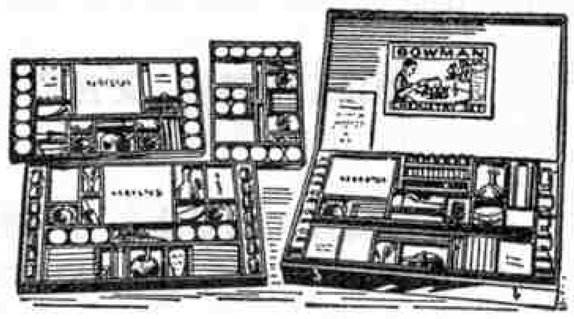


DYNAMO No. 839

Super efficient dynamo on new principle. Gives bright light with smallest steam engines. Fitted drilled metal base, Meccano pattern by permission. With bulb—No. 839 at **7/6**

Also 840 at **5/–**

CHEMISTRY SETS



This amazing wooden cabinet, size $15'' \times 22''$, with all chemicals in glass, is offered at special price of **15/–**. See it before deciding.

Other models **2/6 to 21/-**

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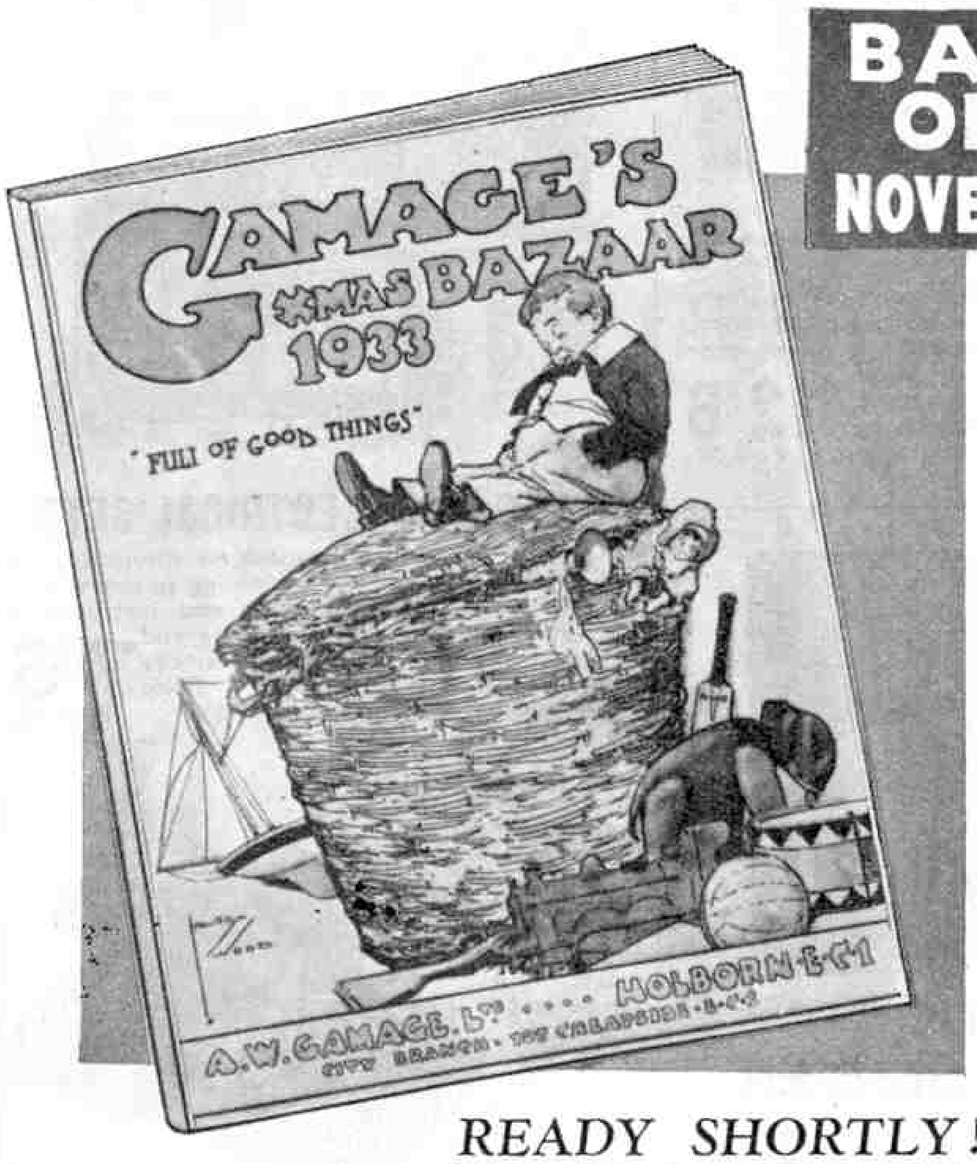
BAZAAR OPENS NOVEMBER 13TH



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64 Pages. Beautifully illustrated in photogravure. Full of Toys, Models, Games and Christmas Gifts for Boys and Girls of all ages. To avoid disappointment send in the application for your copy now as a strictly limited number of catalogues are being printed.

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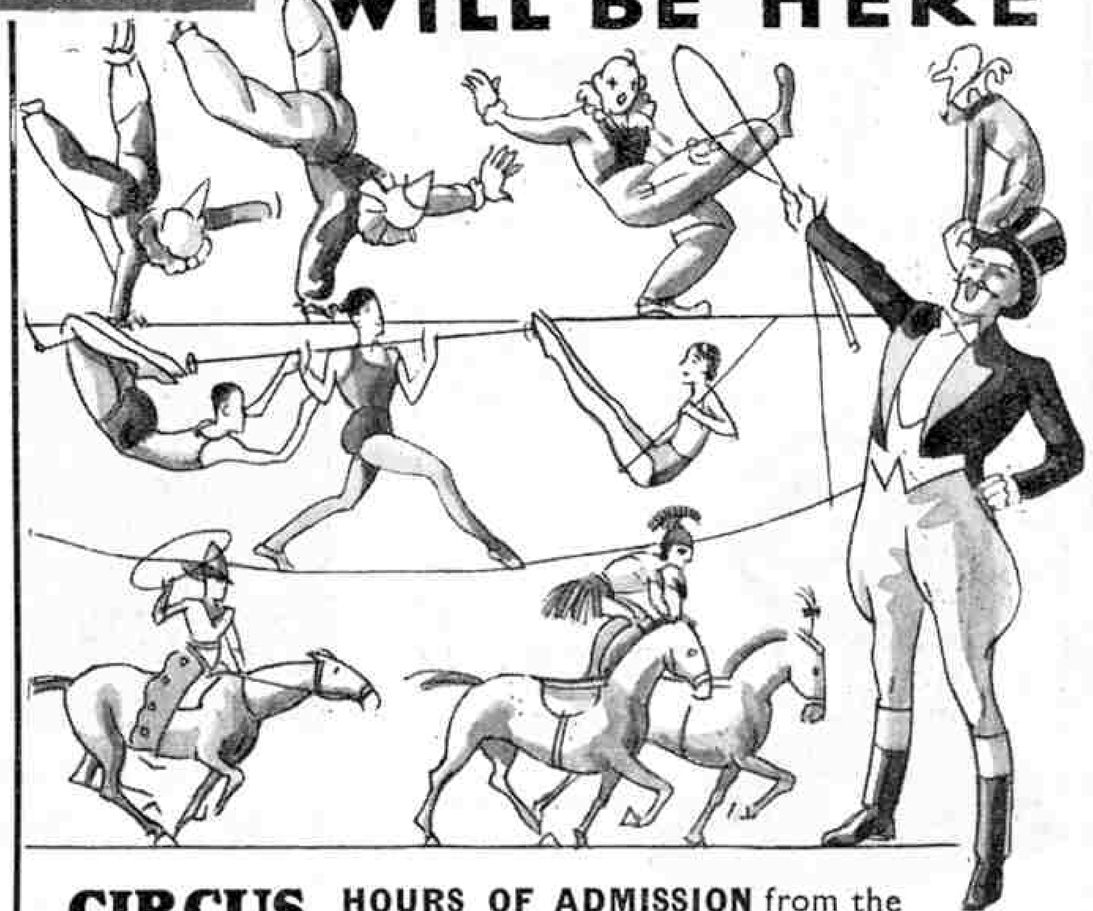

CIRCUS HOURS OF ADMISSION from the 13th Nov. to 2nd Dec. :—1, 2, 3, 4, and 5 o'clock, Saturdays 11.0 and 12.0 o'clock. From 4th Dec. until Dec. 22nd, performances will be at 12, 1, 2, 3, 4, 5 and 6 o'clock, Saturdays 10.30 a.m., 11.30 a.m., and 12.30 p.m. Saturday, Dec. 23rd, at 11, 12, 1, 2, 3, 4 and 5 o'clock.

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Book Your Seats Now **P.T.O.**

GAMAGES · HEADQUARTERS FOR MECCANO & HORNBY

GAMAGES, HOLBORN, LONDON, E.C.1. *Telephone: Holborn 8484.*

GAMAGES • HEADQUARTERS FOR MECCANO & HORNBY

XMAS AT GAMAGES

Something Electrical! You are interested, of course. Gamages have a wonderful range of electrical models and apparatus. Here's a page of Telephones, Morse-code Sets, etc., that will suggest some marvellous Christmas Gifts.

A WORKING MODEL TELEPHONE
—Makes a Perfect House 'Phone

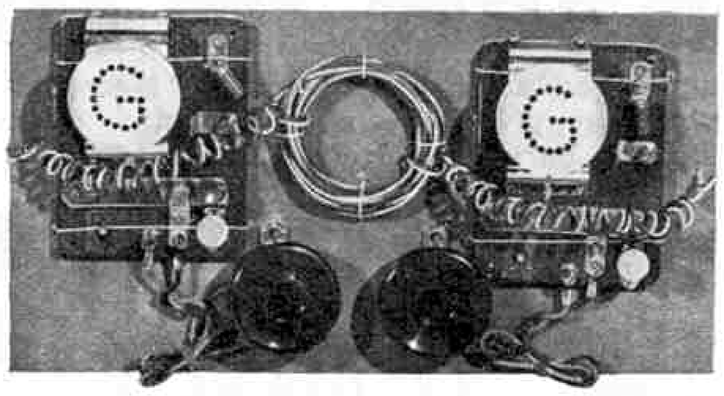
Whether they are used merely as a toy or to save unnecessary journeys in the house, Gamages Telephones can be fixed anywhere in the house within five minutes, the only power required being a flash-lamp battery, which will last for three months.

The model illustrated consists of a polished Bakelite Pedestal and Telephone, and the Signalling Buzzer is housed inside the pedestal. Calling is entirely automatic; immediately the instrument is removed from its base the signal is given by the distant set.

Although an ordinary pocket battery is used this wonderful set will give telephone communication up to one mile. Battery 4½d. extra. Price 35-ft. Flex is supplied. Extra Flex—50 ft. 4/–. 100 ft. 7/6. **25/6**

THE KAY ELECTRICAL SET

The set, as illustrated, is comprised of a medical coil, three lamps, insulating tape, two-way switch, battery tester, screwdriver, wander plugs, flex, staples, bell and bell push. Price **10/6** Post 9d.
Other sets 3/6, 5/6, 7/6 and 21/–.



A HOUSE TELEPHONE for 12/6

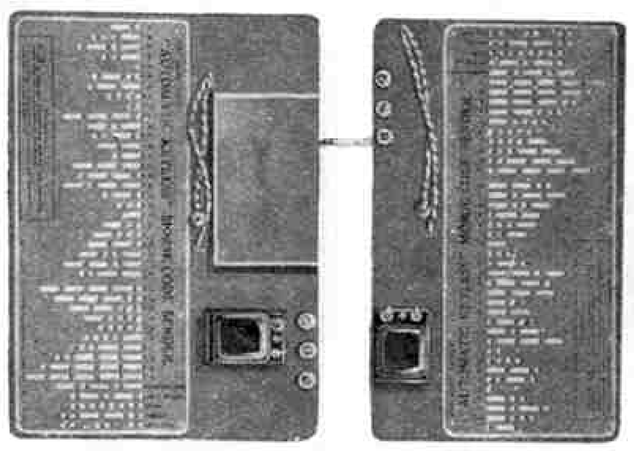
No construction necessary. Merely insert an ordinary pocket battery and the telephone is ready for operation. Audition is perfect over long distances. It is not even necessary to speak close to the mouth piece as the Carbon Granule Transmitter acts as a microphone. **FLASHER SIGNALS.** Price **12/6** Post 9d.
15-ft. Coil triple bell wire supplied with the set.
Extra lengths: 30 ft., 1/6; 60 ft., 3/–.

THE B.G.L. ELECTRICAL SETS

A series of sets which demonstrate the principles of electricity in a manner fascinating to every boy. Set No. 1 contains apparatus and instructions for carrying out many interesting and instructive experiments in electricity and magnetism. Price **7/6** Post 6d.
Other prices 12/6, 18/6, and 27/6

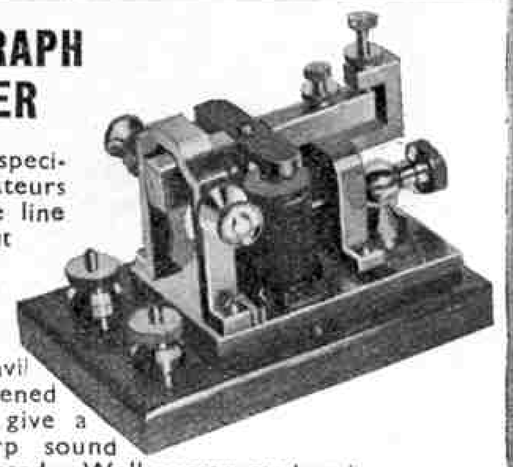
MODEL SEARCH-LIGHT

Will throw a beam of light 40 ft. in the air. Strongly made and finished in black. Replaceable battery fits in base. Dimensions: Height to top of light, 4½ in. Size of base, 4 in. x 3 in. Diameter of lens, 2 in. Price complete with battery **3/9** Post 6d.



AUTOMATIC MORSE CODE SENDER

The latest idea in Morse Code Sets. Amusing and instructive. The easiest and quickest method of learning the Morse code. Just slide the key slowly over each letter as required, and this is transmitted to the receiver at the other end of the buzzer. Price **10/6** Post Free



TELEGRAPH SOUNDER

Designed specially for amateurs and private line work, but can be used in any telegraph circuit. The lever and anvil are of hardened brass and give a clear, sharp sound when operated. Well constructed and finished. Resistance 20 ohms. Usual Price 21/– Gamages Clearance Price **5/–** Post 9d.

SEE THE MARVELLOUS RADIO-TELE-CONTROLLER

One of the star attractions of the Bazaar. Major Raymond Phillips, O.M.E., the famous Scientist and Inventor, presents the marvellous Radio-Tele-Controller. He demonstrates how the human body forms a battery and controls a model railway. He also demonstrates the wonderful new electrical meter, which shows how much electricity your body generates.

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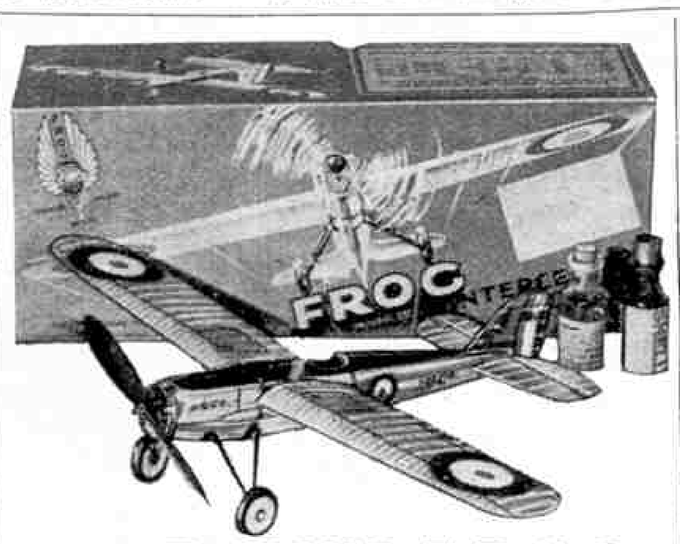
XMAS AT GAMAGES

Model Aeroplanes and Clocks, Yachts, Speedboats, Cinematographs, Microscopes! Below we illustrate a few from Gamages unrivalled selection. What wonderful Christmas Presents they make.

Build this Fine WORKING MODEL CLOCK

Here's a grand constructional set which, when assembled, is a real clock with a 30-hour movement. An accurate timekeeper, too. The complete set of parts and simple instructions costs you Only **2'11** Post 6d.



THE FAMOUS F.R.O.G. MODEL AEROPLANES

Without a doubt the most scientific model aeroplane ever made. Has many novel features: collapsible wings, undercarriage and gear-box, making it practically unbreakable. FLIES RIGHT OFF THE GROUND with a run of 8 ft., and travels 75 yards, or when hand-launched 100 yards. Supplied in box with patent winder, inserter rod for new motors, motor lubricant and Shell Oil. R.A.F. markings. Also supplied in Italian, Belgian, Dutch, French, U.S.A., and Argentine markings at the same price. Price **7'6** Post 9d.

THE GAMAGE "SHAMROCK" MODEL RACING YACHT

Price **21'-** Post Free

The hull is correct to scale in dimensions and profile of the latest "Shamrock." Deck is cambered, hull carved from best yellow pine, "Bermuda Rig," sails made from spinnaker cloth. Hull is enamelled sea green. Deck is lined and varnished. Stand supplied. Length, 27 in.

ASKALITE

An amusing and educational toy. Contains 48 metal studs, over which a perforated sheet bearing questions and answers is placed. Complete with 288 questions and answers. As soon as a correct answer is found the light automatically flashes. Price complete with battery **2'11** Post 6d.

EXTRA SETS OF QUESTIONS EXCLUSIVE TO GAMAGES, 6d. per packet.

GAMAGES FUSELAGE MONOPLANE

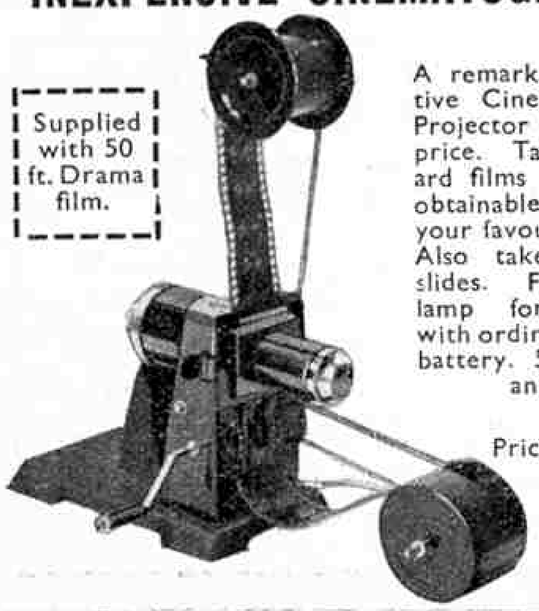
Price **10'6** Post 9d.

Scientifically constructed and designed. Will rise from the ground and fly very steadily—even in strong winds. Fuselage covered in silk and silver coloured. Wings and tail-plane of yellow proofed silk. Can be adjusted to do various stunts. Span, 26 in. Length, 21¼ in. Strongly recommended.

LAUNCH WITH AUTOMATIC STEERING

The amazingly clever feature of this clockwork-driven boat is that it will go out in a straight line, almost 150 ft. and **RETURN AUTOMATICALLY.** Speed is 100 ft. per minute, and it cuts through the water just like the real speed-boats. Length, 17 in. overall. Price **18'6** Post 9d.

AN EFFICIENT AND INEXPENSIVE CINEMATOGRAPH

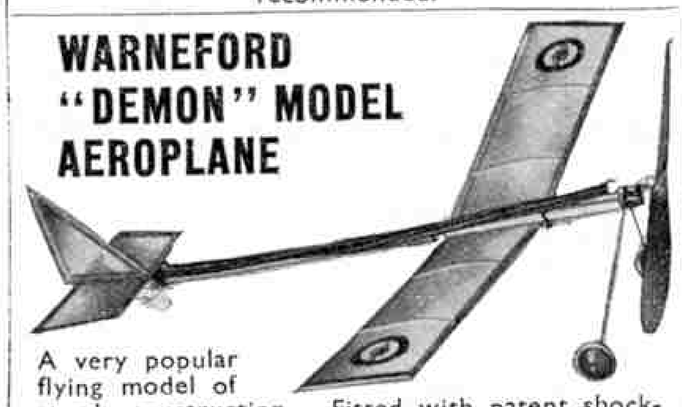


Supplied with 50 ft. Drama film.

A remarkably effective Cinematograph Projector for the price. Takes standard films which are obtainable with all your favourite Stars. Also takes lantern slides. Fitted with lamp for lighting with ordinary pocket battery. 50 feet film and 3 slides.

Price complete **6'9** Post 6d.

WARNEFORD "DEMON" MODEL AEROPLANE



A very popular flying model of sturdy construction. Fitted with patent shock-proof chassis, and covered with yellow proofed silk. Will rise from the ground and has a flight of 300 yards, undoubtedly a fine performance for a machine of this price. Wing span, 23 in. Length, 25½ in. 10-in. propeller. Price **7'6** Post 9d.

POCKET COMPASS

A first quality compass of French manufacture, 2" in diameter. Agate centre for smooth movement. Luminous arrow and luminous points N.S. E.W. Stop for preventing movement when not in use. Price **3'6** Post 3d.

STUDENT'S MICROSCOPE

Manufactured by a leading scientific instrument manufacturer. Heavy metal body, crackle ename finish. Focussing by sliding tube. Magnification 25X. Complete in cardboard box with two plain slides and one specimen slide. Wonderful value. Price only **12'6** Post 6d.

Foreign

MICKEY MOUSE LANTERN OUTFIT

The latest home entertainer. Eleven different stories of Mickey Mouse specially drawn by Walt Disney. Each story consists of 8 pictures (2 slides), complete with reading matter. A specially designed projection lamp is supplied. Illuminated by ordinary pocket bulb and battery. Complete with two batteries and bulb. Packed in neat fibre attache case. Price **12'6** Post 9d.

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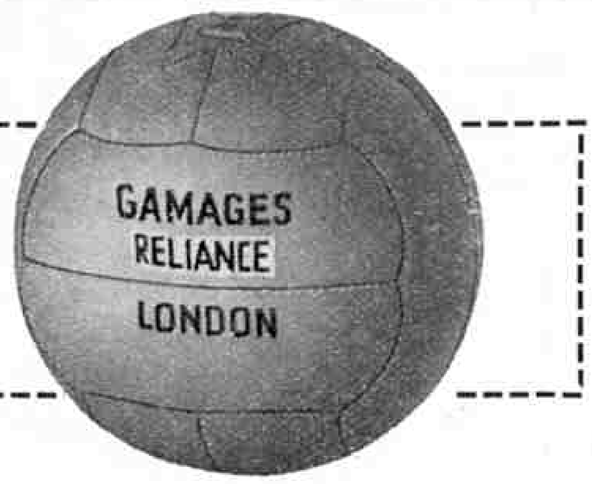
XMAS AT GAMAGES

Whether you are fond of outdoor sports or indoor games and entertaining, there is something to interest you here—Football, Skating, Shooting, Billiards, Conjuring, etc. It is another example of how thoroughly Gamages cater for the needs of the modern boy.



GAMAGES 'RELIANCE' FOOTBALL

Specially made to meet the demand for a strong school ball. Its hard-wearing qualities are renowned in schools throughout the country. Hand-sewn throughout. Size 5 (Match size) **8/11** Post 6d.
Size 4, **8/6**; Size 3, **7/11**.

THE SCOOTA-SKATE

This very fine skate is adjustable to all sizes, thereby making it serviceable to a youngster for a long period. Is safer than an ordinary scooter. Made of fine quality steel throughout with rubber tyred disc wheels. Price **3/6** Post 9d.

GAMAGES POPULAR CONJURING TRICKS

The immense popularity of Gamages Boxes of Conjuring Tricks is due to the wonderful value offered. This year all boxes are better equipped than ever. Every box contains a grand assortment of mystifying tricks. Box A, as illustrated, complete with full instructions. Price **7/6** Post 6d.

New Hornby Locos for Old!

Gamages specialise in Hornby Part Exchange Scheme for Locomotives. Write and ask us how you can obtain a new Locomotive for an old one—we will post you a leaflet with full particulars by return.

BROOMRANG PUNCH BALL

Provides a healthy pastime for Boys. Can be easily inflated. The ball is attached to the head by a rubber strand fastened to a strong band, fixed round head. Ball has a good bladder, and reliable quality case. This is great fun for boys of all ages. Price **3/11** Post 6d.
Superior quality **5/6**

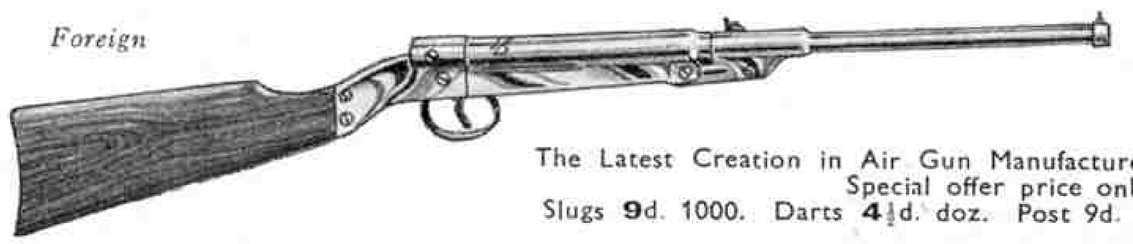
Boys' Boxing Gloves

With elastic wrists. Price **10/6** per set of 4. Youth's **12/6**. Post 6d.

THE FAMOUS "DIANA" AIR GUNS AND RIFLES

Well Made—Exceptionally Low Priced

Foreign



THE "DIANA" AIR RIFLE

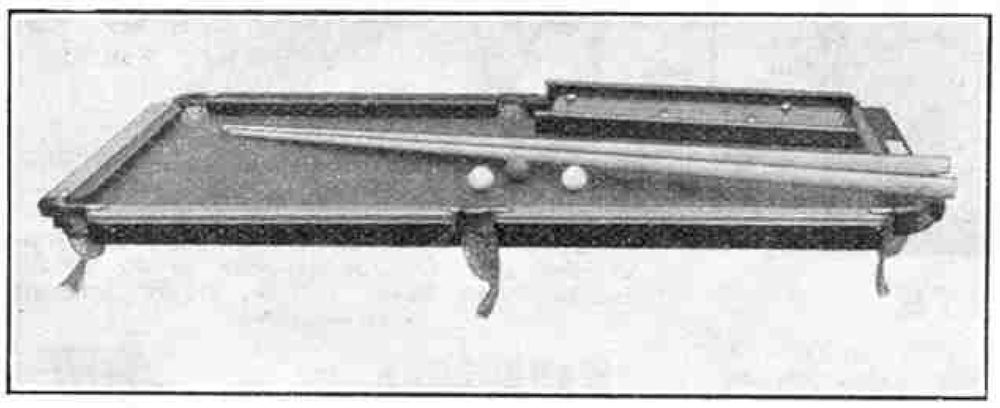
(Patent)

The Latest Creation in Air Gun Manufacture. Special offer price only **10/6** Post 9d.
Slugs **9**d. 1000. Darts **4½**d. doz. Post 9d.

Foreign

THE "DIANA" AIR GUN

The World's Best Air Gun value. Single shot. Muzzle loading. Shoots darts or slugs. Length 31 in. over all. Special Offer Price **4/9** Post 9d.



MINIATURE BILLIARD TABLES

Show this to Dad and point out what a wonderful attraction one of these tables will be in the home. Specification :— Adjustable legs, compo. board bed, covered with good green cloth, rubber cushions, cues and set of composition balls, marking board, etc.

3 ft. 0 ins.	Oak or Mahogany	**19/6**
3 ft. 6 ins.	" " "	**23/6**
4 ft. 0 ins.	" " "	**35/-**
5 ft. 0 ins.	" " "	**55/-**

Carriage Paid in London Radius.

★IF YOU HAVE DECIDED ON A MECCANO SET, HORNBY LOCO OR SPEED BOAT—

Remember that as National Headquarters for all Meccano Constructional, Electrical and Chemistry Sets and Hornby Trains and Speed Boats, we have the largest stocks in the country, and can give prompt delivery. During the great Christmas Bazaar specially augmented displays of Meccano and Hornby goods will be on view. Our Meccano and Hornby experts are always ready to give advice and service.

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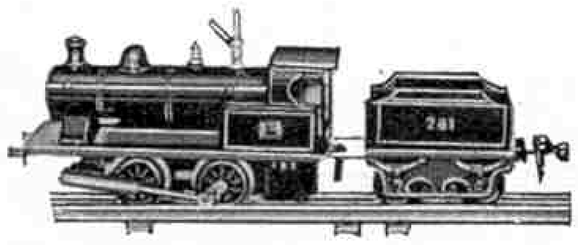
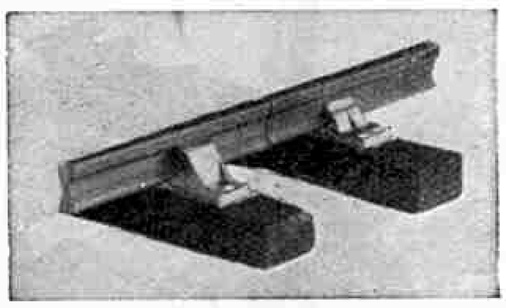
BARGAINS in Gauge "O" Locomotives

Clockwork Express Locomotives.
4–6–0 type, fitted with the most powerful mechanism made. Fitted brake and reverse operated from cab or track. L.M.S., L.N.E.R., G.W.R., S.R. colours. Price **36/–**. Postage 9d.

Clockwork Mixed Traffic Locomotives.
0–6–0 type, fitted with the most powerful mechanism made. Fitted brake and reverse operated from cab or track. L.M.S., L.N.E.R., G.W.R., S.R. colours. Price **28/6**. Postage 9d.

Steam Locomotives.
Powerful Steam Gauge "O" Locomotive, fitted methylated spirit lamp, oscillating steam cylinders, brass boiler with safety valve and whistle.
Price **14/6**. Postage 6d.
Tank Locomotive, similar to above.
Price **12/6**. Postage 6d.





Run your trains on correct Steel Permanent Way. All Model Trains will run much further on this track.

Rails	**1/6** doz. yds.	Sleepers	**2/–** per 100
Fishplates	**4d.** doz.	Battens	**1/9** per doz.
Chairs, Cast Slide On...	**1/2** per 100	Pins	**9d.** ¼ lb.
		Track Gauge	**9d.**

Finished Track from **7½**d. per 18" length.
All above prices postage extra.
Send for Bond's New 1933–1934 Catalogue, it is bigger than ever. Price **6d.** post free.

BOND'S O' EUSTON ROAD LTD.
254, EUSTON ROAD, LONDON, N.W.1

'Phone: Museum 7137. Est.d. 1837.

Patent No. 370576

TRADE **XACTUS** MARK
REGD.

FLYBIRDS—Completed Models

FOKKER TRIPLANE
PUSS MOTH
HAWKER FURY
COMPER SWIFT
KLEMM MONOPLANE
MARTYNSIDE
S.E.5
BLACKBURN SEGRAVE
SOPWITH CAMEL
FOKKER VII
NIEUPORT SCOUT
GYPSY MOTH
AUTO-GIRO

All at 1/6 each, postage 3d.
AVRO 504—Flybird, price 2/–, postage 3d.

MODEL-CRAFT—Constructional Sets in Balsa Wood

No. 1 FAIREY LONG RANGE MONOPLANE
No. 2 BRISTOL FIGHTER
No. 3 AVRO CADET
No. 4 S.E.5a
No. 5 AVRO 504
No. 6 PERCIVAL GULL
No. 7 WESTLAND WALLACE
No. 8 MILES HAWK

Price 6d. each, postage 2d.

1/40th Constructional Sets

D.H. MOTH
BLACKBURN BLUEBIRD
SUPERMARINE S.6
AVRO AVIAN
WESTLAND WIDGEON
PUSS MOTH
HAWKER FURY
GLOSTER FIGHTER
COMPER SWIFT
DESOUTTER COUPE
FAIREY FOX
FAIREY IIIF.

Price 2/6 each, postage 4d.

AIRPORT—Complete Outfit in box—price from 15/– to 63/–, postage 1/–
HANGAR SET—Complete in box—price 5/– each, postage 9d.

Obtainable at all Toy Stores or direct from :—

THE XACTUS MODEL CO. 717, LONDON ROAD, THORNTON HEATH, SURREY

Shops and Wholesalers for London and Southern England :—
Messrs. F. MAYERS LTD., 111, WESTBOURNE GROVE, LONDON, W.2

Scotland and Northern England :—
Messrs. COWAN DE GROOT LTD., 14, BUNHILL RD., LONDON, E.C.1

Brock's have been catering for "Fifth of Novembers" for 200 years, so they know how to produce good fireworks, whether it's the smallest squib or the largest rocket. Pay a visit now to the nearest shop selling Brock's and have a look at the wonderful collection they've got ready for you. "Crystal Palace" Fireworks are made in all sizes and prices from a ½d. upward and *every one* is absolutely reliable. Ask for them by name —BROCK'S "CRYSTAL PALACE" FIREWORKS.

royds

A selection from the fine range of Tri-ang Toys

(Regd. Trade Mark)

No. 26C. DOLL'S PRAM. In every way the finest doll's pram on the market. A de luxe article at a popular price. The specification includes :—All steel body with moulded sides, outside springs, 7 in. tangent spoke wheels, 1⅛ in. Solar tyres, rubber duck hood, apron and storm flap, all bright parts chromium-plated, chromium levers, four mudguards, laced hood. Size of body, 26 ins. long. Available in standard colours.

PRICE **75/-**

SCOOTER F/8. Frame constructed with the best weldless steel cycle tubing and fitted with 10 in. tangent spoke ball-bearing wheels, and ⅞ in. sponge rubber tyres. Finished in blue with chromium-plated handle bars and fittings.

PRICE **22/6**

FAIRYCYCLE (Regd.) Model No. 2. Tubular frame, 14 in. wheels, 1⅛ in. white auto tread tyres, ball-bearing pedals, rim brake now fitted, two-coil saddle, chain cover, stand, black or blue, chromium-plated fittings.

PRICE **39/6**

No. 22C. DOLL'S PRAM. A new and attractive model with all steel body. Elegant design moulded on sides. Specification includes :—Outside strap hung springs, 7 in. tangent spoke wheels, 1⅛ in. Solar tyres, rubber duck hood and apron, all bright parts chromium-plated, chromium levers, four mudguards, lace hood. Length of body, 22 ins. Available in standard colours.

PRICE **45/-**

TRI-ANG TOYS

(REGD. TRADE MARK)

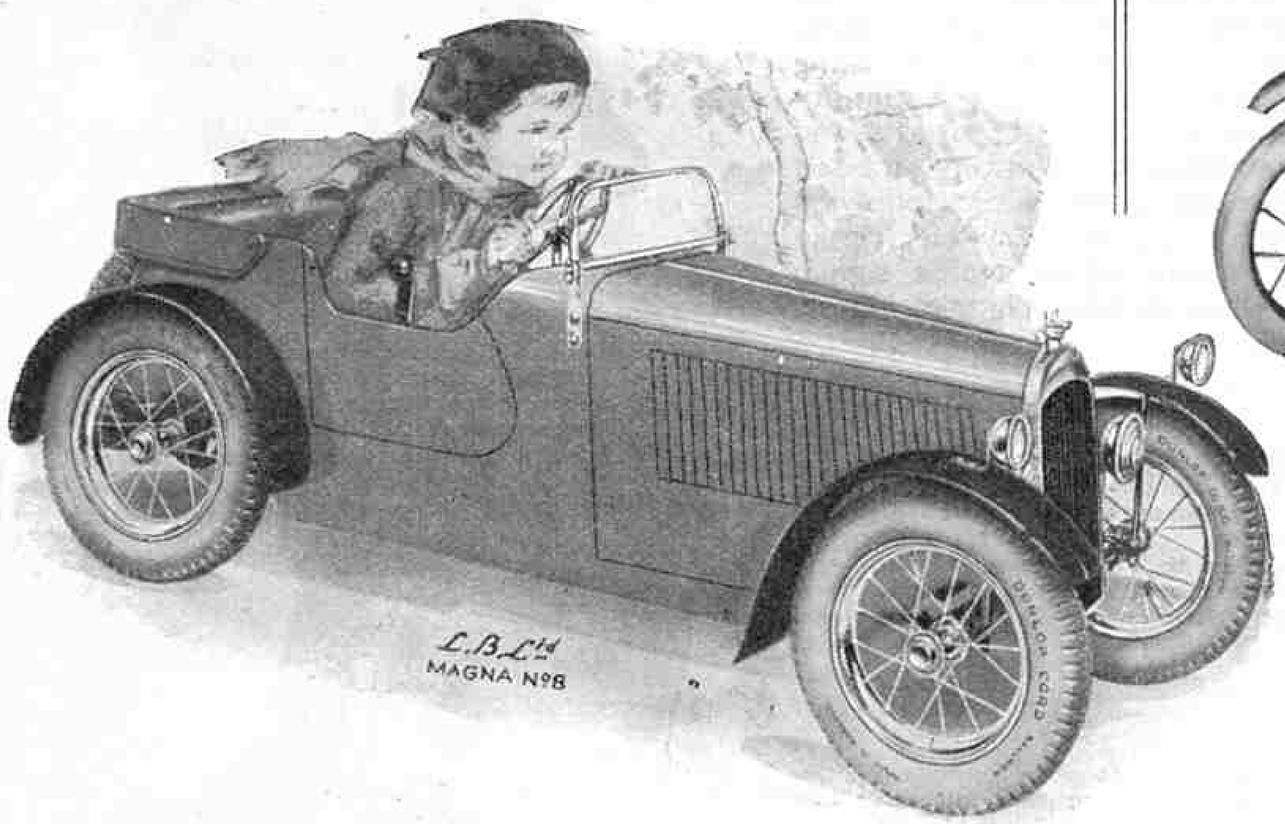
British made by—

LINES BROS. LTD., TRI-ANG WORKS, MORDEN ROAD, MERTON, LONDON, S.W.19

A Selection of TRI-ANG (Regd.) Popular Cars

17/11 ● COMET. Moulded steel body with plated radiator. Large balloon wheels with rubber tyres. Double crank drive with rubber pedals. Two dummy lamps and petrol and oil cans. Finished in red. 31 ins. long

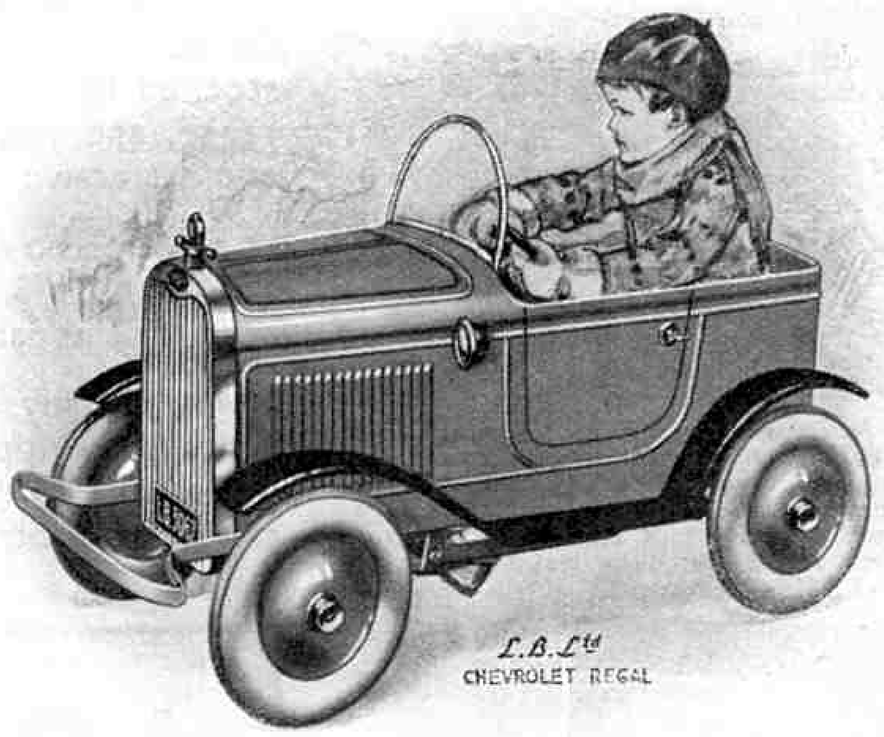
Send for our big new coloured list of the latest Tri-ang Toys and Cars



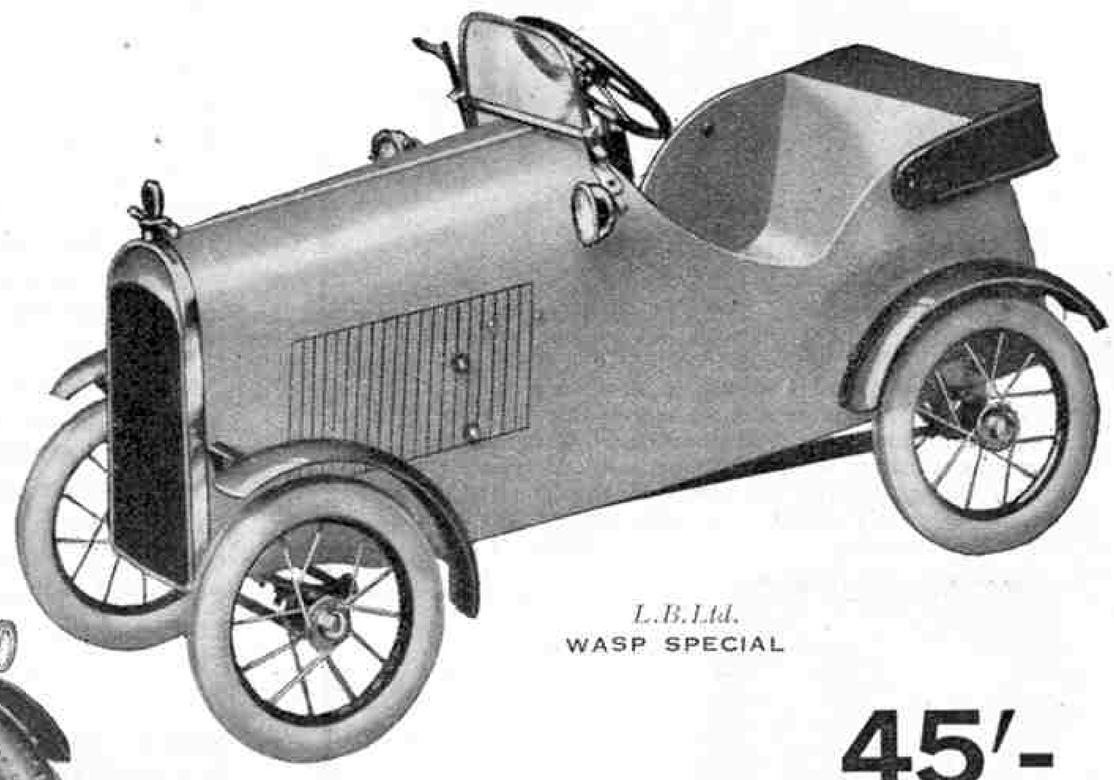
£5/9/6

Spare Wheel and Tyre 10/- extra

● MAGNA No. 8. A fine model of a modern Sports Car. Low built body gives racy appearance. Very easy running. Double crank drive with ball-bearing back axle and tubular front axle. Strong band brake. Tubular windscreen, direction indicator, four sports type mudguards, side-opening door, 5 lamps. Fully upholstered back and seat. Dummy hood. 2¼ in. Dunlop pneumatic tyres, tangent spoke wheels with chromium-plated rims. All lamps, etc., chromium-plated. Length 57 ins.



● CHEVROLET REGAL. A smart pedal car with pressed steel body. Adjustable windscreen, spring bumper and correct radiator with badge. 9 in. balloon disc wheels with 2¼ in. rubber tyres. For ages 3–6 years. **29/6**



45/-

● WASP SPECIAL. Latest model of Sports Car with Bentley Type Radiator. Wire wheels fitted with thick white sponge rubber tyres, real automobile pattern. Equipment includes two electric lamps (caps), windscreen, direction indicator, mechanical horn and four sports type mudguards. Body finished attractive orange colour with nickel-plated radiator, shell and lamps. Length 37 ins.

At all good Stores and Toy Shops

BRITISH MADE BY

LINES BROS. LTD.

Tri-ang Works, Morden Rd., London, S.W.19

LOTT'S CHEMISTRY

BRITISH MADE

BOX 3. As illustrated above. Contains 30 chemicals, bunsen burner with rubber connecting tube, large and small test-tubes, flask with rubber cork and delivery tube, porcelain crucible, glass funnel, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush and Book of 131 experiments. Price **10/6**

There are hours of really interesting experimenting ahead of the Boy who possesses a box of Lott's Chemistry, for these Sets have been designed on sound scientific lines by an eminent Doctor of Science. They are stocked by all leading toy dealers and stores. Ask to see the complete range, and you will not fail to be impressed by the genuine good value and attractive appearance of the sets.

In addition to the three sets illustrated there are other sizes at 3/6, 6/–, 15/6 and 31/6. Also large Students' Cabinets containing comprehensive ranges of apparatus at 73/6 and 105/–.

If you already have a Chemistry Outfit, ask to see Lott's Spares Outfits containing supplies of glassware, etc. There are three different kinds each priced at 2/6 each. Spare supplies of all Chemicals and other apparatus can also be obtained.

BOX 5. An especially fine set, Box 5 contains 43 chemicals and apparatus for a remarkable range of 228 experiments. The additional apparatus over and above the contents of the earlier boxes includes retort stand and ring (of great use in arranging the apparatus in a firm and convenient form), wire gauze, beaker and crucible tongs. Extra bottles of some of the chemicals most frequently used are also included. As illustrated above. Price **21/–**

BOX 7. In this Cabinet illustrated above, the young experimenter is provided with a really useful range of laboratory equipment. It contains 54 bottles and cartons of chemicals and the apparatus includes glass retort, retort stand with two rings, deflagrating spoon and cap, pestle and mortar, sandbath, tripod, pipe-clay triangle, glass stoppered bottles, etc., etc. Complete with full instructions and notes on the use of the apparatus. Price **42/–**

LOTT'S ELECTRICITY

A NEW RANGE OF SCIENTIFIC SETS

Lott's Electricity Sets provide every Boy with the means of demonstrating in an interesting and practical way, the principles underlying the action of electrical instruments and machinery. Three different sizes in boxes are at present available. Except for a few articles commonly found in every house, the various sets contain everything necessary for a fascinating series of experiments in magnetism, static, and current electricity. Working models and instruments such as the following can be made :—buzzer, relay, electrically operated railway signal, traffic signal, gold-leaf electroscope, electric motor, etc., etc.

BOX 1. Contains apparatus and fully illustrated instruction booklet for 42 experiments, including magnetic and compass experiments, static electricity, battery making, galvanometer experiments, electro-plating, etc., etc., as illustrated above. Price **6/–**

BOX 2. Contains apparatus and instructions for 84 experiments, including measuring of currents, resistance experiments, further experiments in magnetism, relay, buzzer, electrically operated railway signal, traffic signal etc., etc. Also contains two complete Leclanche cells with necessary chemicals, as illustrated on right. Price **12/6**

BOX 3. In addition to the contents of the previous boxes, this set contains apparatus and instructions for experiments with the following :—electroscope, electrophorus, electric motor, Wheatstone's Bridge, hot-wire ammeter, etc., etc. —126 experiments in all. Contains also a powerful horseshoe magnet, a built-up buzzer, and three Leclanche cells. Price **21/–**

These prices apply only in Great Britain and Northern Ireland. Agents in South Africa: Stuttaford & Co. Ltd., Capetown; Canada: T. Eaton & Co., Toronto; H. Morgan & Co. Ltd., Montreal.

Write for Free illustrated lists to

Dept. M.M., Lott's Bricks Ltd., Watford, England.

NIGHT RIDE IN SAFETY!

Reflectors and ordinary rear-lamps have their points, but this NEW device beats them all—it *flashes* a compelling red beam that unfailingly attracts the attention of an overtaking rider or motorist. The flashing red light is a *proved* safety device on cross-roads. Now put it on your machine and ride in SAFETY. Absolutely reliable.

Made in Birmingham under British Pat. No. 361,120

COMPLETE SET **6/11** *WITH* **AUTOMATIC — FLASHING REAR LAMP**

less battery

SOLE PRODUCERS:

BAEDEKERS Ltd.,

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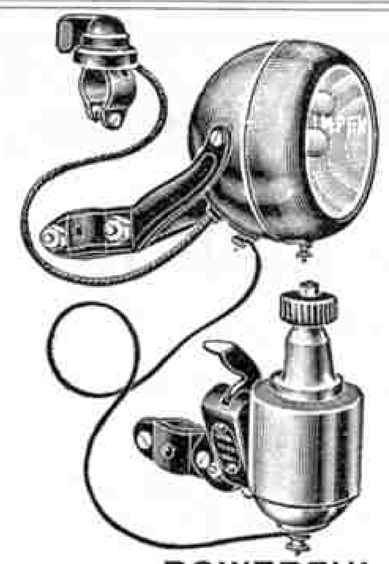
WINKLITE THE LIGHTING SET WITH A FLASHING REAR LAMP



THE LATEST LIGHTING SET

FOR YOUR CYCLE

This new set is without question the finest value ever offered.

The Headlamp has a very attractive appearance and gives a penetrating beam of light, and is completely CHROMIUM PLATED.

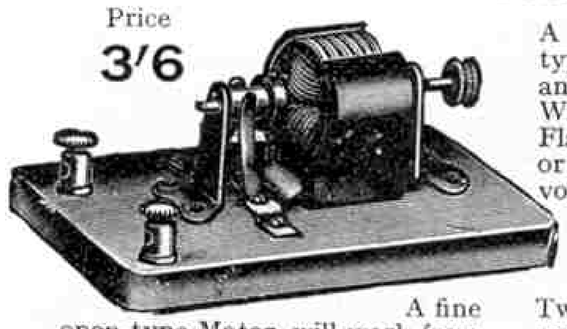
The two bulbs and switch enables you to dip the light, and will work off either the Dynamo or Battery.

The DYNAMO is also CHROMIUM PLATED and the automatic voltage regulator prevents bulbs from breaking when travelling fast whilst ample current is generated at a walking pace.

PRICE COMPLETE WITH ALL LEADS AND BULBS **23/-**

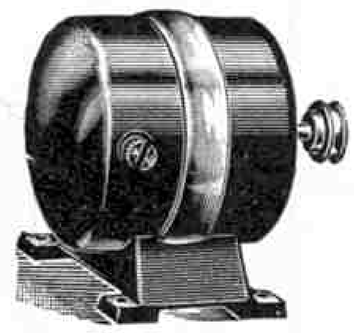
POWERFUL ELECTRIC MOTORS

Price **3/6**



A fine open-type Motor, will work from a 4-volt Flash Lamp Battery or Accumulator, can be supplied in parts for building yourself, with full instructions.

A new enclosed type, very speedy and smooth running. Will work off a Flash Lamp Battery or better still a 2/4-volt Accumulator Price **7/9**



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Two new Mains Models of superior finish to work off the Electric Light Mains giving unlimited power at practically no cost.

1/100 h.p., 2 Pulleys on shaft. Price **17/6**

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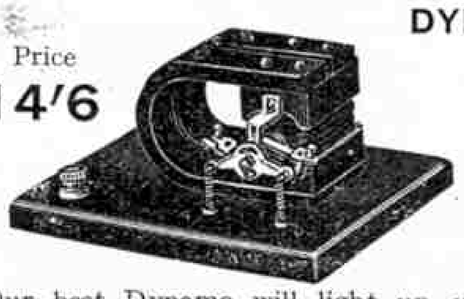
DYNAMOS

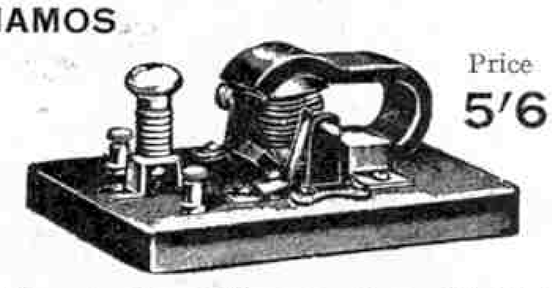
Price **14/6**



Our best Dynamo will light up your Models or Railway with SIX 3.5 volt Bulbs easily. Base $6\frac{1}{4}'' \times 4\frac{1}{4}''$.

Send for our new illustrated Catalogue 4d. Post Free.

Price **5/6**



A strong Dynamo that will light up your Models or Railway with a 3.5-volt Bulb easily. Base $4\frac{3}{4}'' \times 3''$.

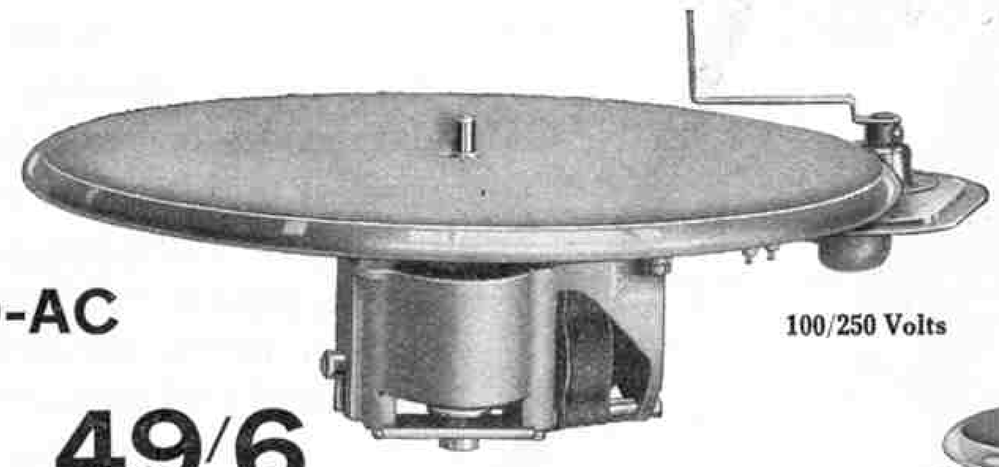
Orders over 10/– Post Free in England otherwise 6d. extra. Abroad 1/–.

L. WILKINSON, 8, CITY ROAD, LONDON, E.C.

ELECTRIC GRAMOPHONE MOTORS

B T-H

TRUSPEED-AC



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All models fitted with Automatic Stop Switches.

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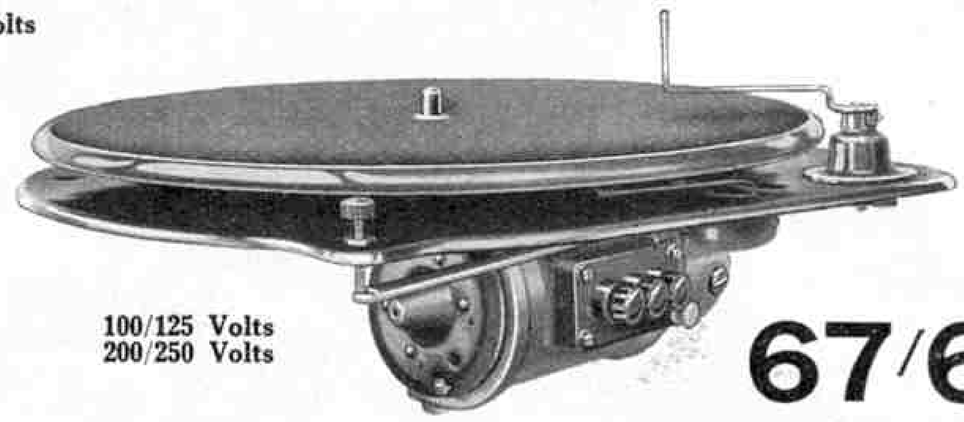

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UNIVERSAL for A.C. & D.C. circuits ,, 110/-

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THE BRITISH THOMSON HOUSTON COMPANY LIMITED, RUGBY ENGLAND A1561N

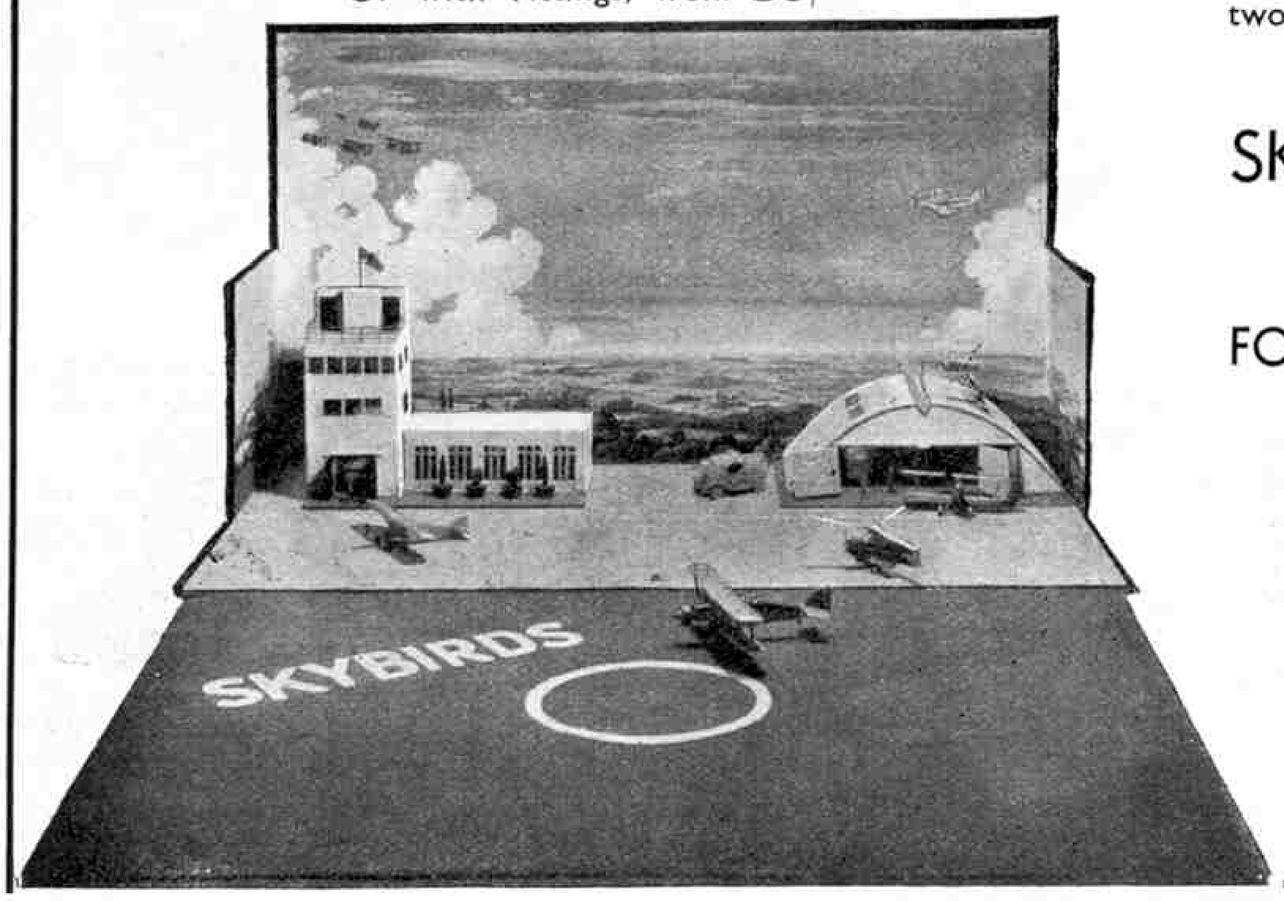
Every SKYBIRD Collector will want THE NEW SKYBIRD AIRPORT

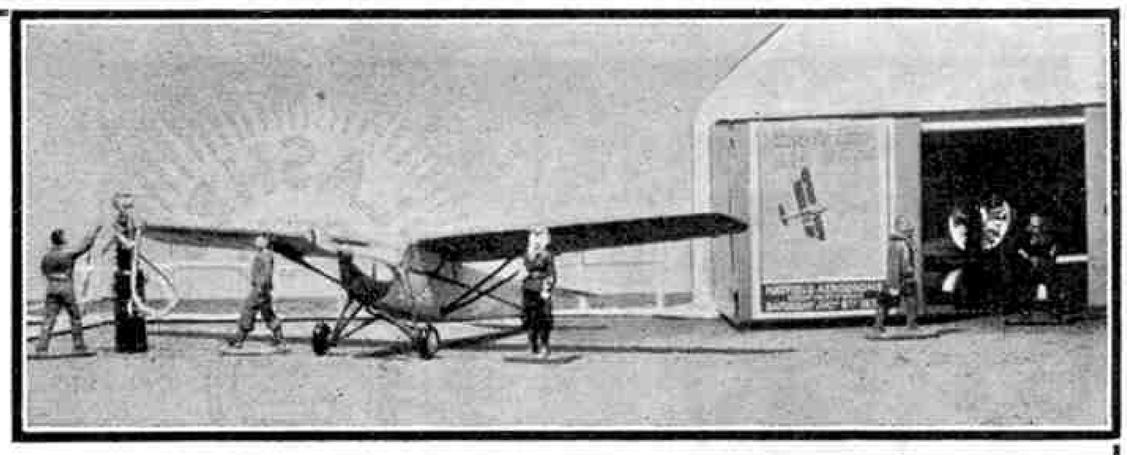
FOR DISPLAY AND EXHIBITION.

Compact, portable, keeps everything safe and tidy.
Can be opened out and packed in a few seconds.
Lends realism to your photographs.
Opened out, the back scene in 8 colours, measures 36″ x 20″.
The Aerodrome and Landing Field measures 43″ x 36″.

Price 21/-

Or with Fittings, from **30**/-





• What you can do with SKYBIRDS!

This photograph shows a model made from No. 2 Set, 1/6—two or three figures for a few pence—**SKYBIRD MODEL PRATTS PETROL PUMP, 3d.,** and a Hangar, 2/9.

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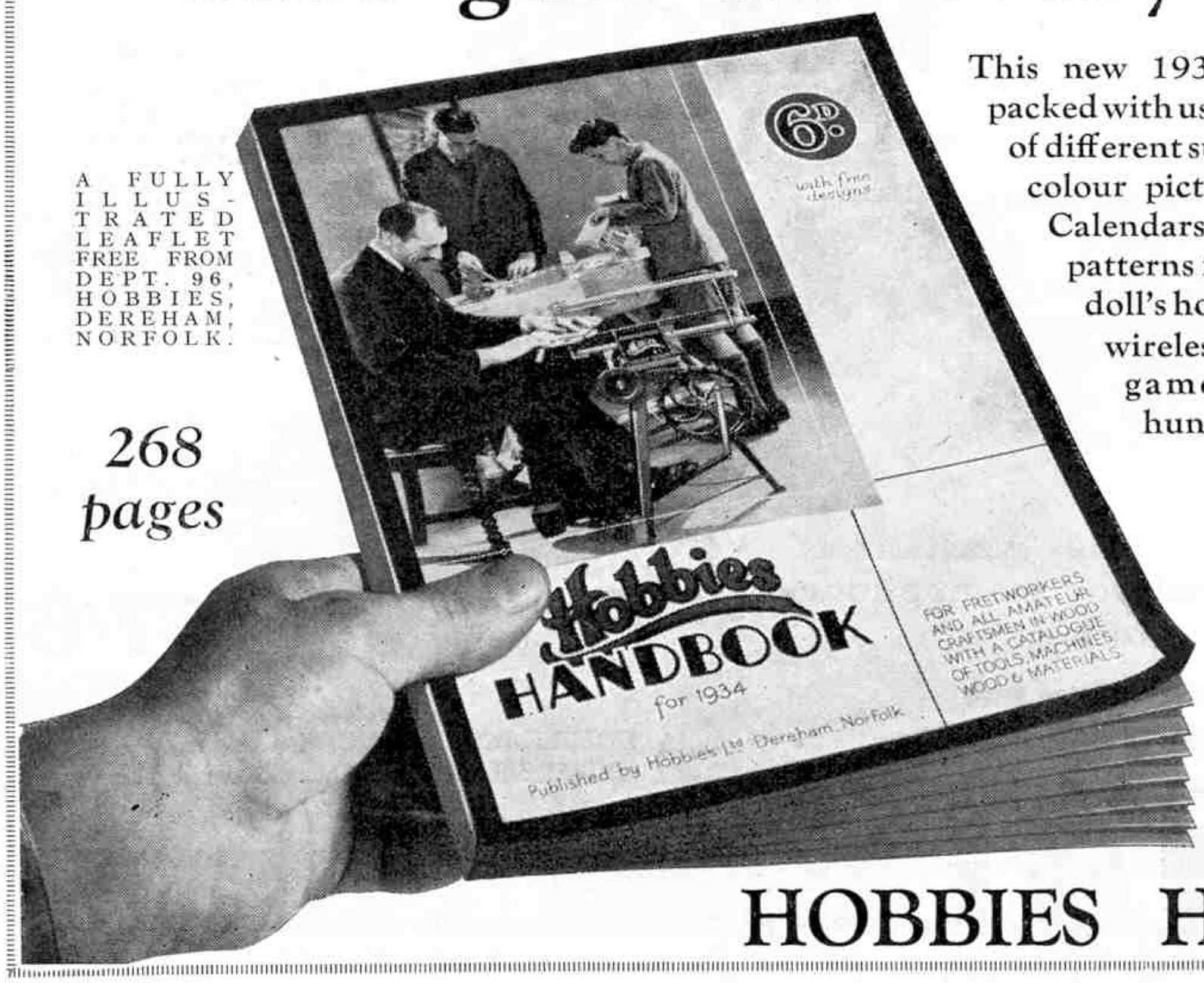

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UNCLE JOE TELLS YOU HOW TO WIN

This is an illustration of the handsome badge that the B.G.L. Club Members wear. It is beautifully enamelled in red, blue and gold.

Watch for our Trade Mark on all your games and toys. It means British-made toys for British girls and boys. B.G.L. toys and games are best.

The B.G.L. Club,
20, St. Clare Street, London, E.1.

Dear Boys and Girls,

I was astonished at the tremendous number of boys and girls that replied to the letter I wrote in last month's Meccano Magazine.

I wish that I could publish some of the messages I received. Many of them might have come from university graduates, they were so perfectly written. Some of them made up for bad writing and poor spelling by extra enthusiasm for the B.G.L. Club. Anyway, I loved having them all and took a personal interest in each letter. What I think about letters is "The more the merrier," so I will be very pleased to hear from any of you, and will personally answer any questions you may ask.

Don't forget that I am still giving away a No. 1 B.G.L. Chemical Set every day until Christmas for the sender of the neatest or the best worded application for membership that I open every day.

Our biggest competition this month is for recruiting new members to the B.G.L. Club. Below, you have two application forms. It is not necessary to use an application form, but perhaps easier. A letter giving the same information will do quite as well. Full details of this competition are given in the November issue of the B.G.L. News which is published this week. Some of the prizes to which you are entitled for enrolling ten new members are shown on this page. You have your choice from many prizes.

This is Uncle Joe who replies personally to all your letters.

Of course, there are other competitions as well, and when you join the B.G.L. Club and receive your Badge and B.G.L. News, you will see just how many prizes it is possible for you to win. All members can compete, and there is no charge for our competitions.

Remember, British Games Ltd. is an "All British" Firm employing only British labour, using only British materials, and financed with British money. You are a real Briton in the B.G.L. Club.

Yours affectionately,

Uncle Joe

P.S.—Remember—a Chemical Set is given away every day for the best letter of application.

ENROL NOW FOR MORE FUN AND PLEASURE

To Uncle Joe, British Games Ltd.,
20, St. Clare St., Minories, London, E.1.

Name.....
In Capitals

Address.....

..... Age.....

I enclose 1/– (P.O. or stamps) and wish to become a Full Member of the B.G.L. Club.

Please send a B.G.L. Club Badge and the B.G.L. News by return of post. If introduced, give Member's No.....

To Uncle Joe, British Games Ltd.,
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Name.....
In Capitals

Address.....

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I enclose 1/– (P.O. or stamps) and wish to become a Full Member of the B.G.L. Club.

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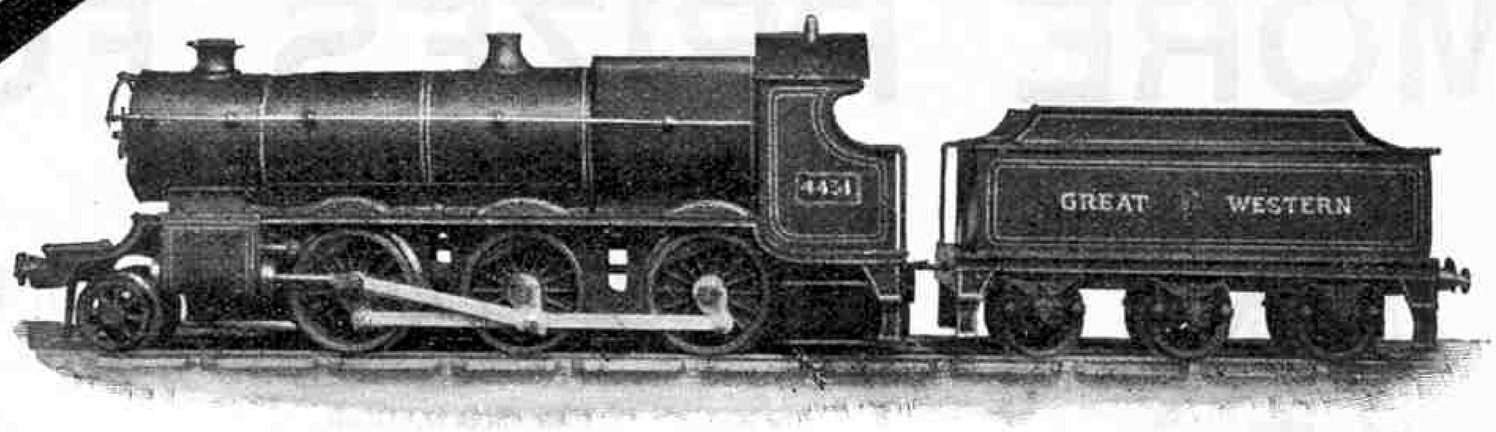
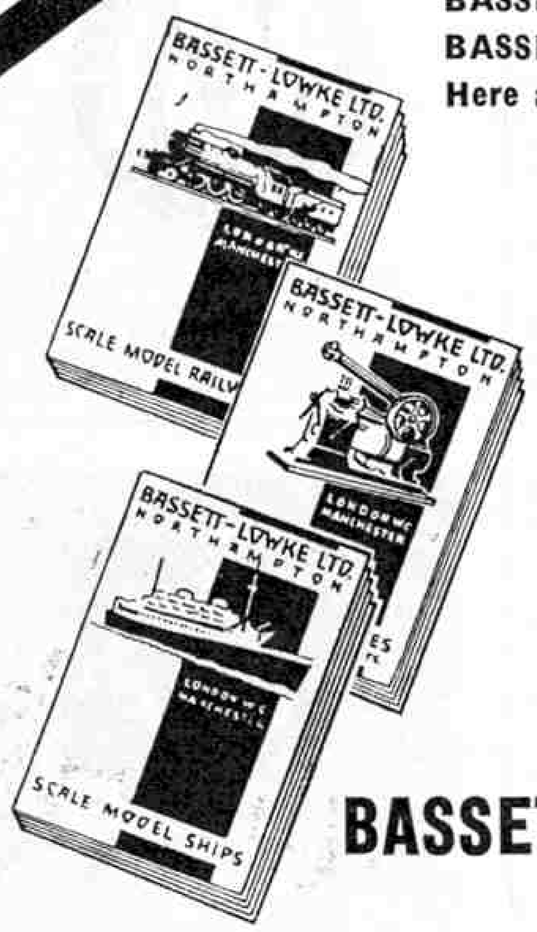
A BASSETT-LOWKE RAILWAY FOR YOU !



ADD A

BASSETT-LOWKE hand-made Scale Model to your Hornby Railway, and give it an aristocratic appearance !
BASSETT-LOWKE goods are standard and can be used on any track.
Here are a few particulars about our hand-made and hand-painted G.O. Scale Model Locomotives :—



- They are the finest commercially produced models of this kind on the market.
- They can be supplied in **clockwork, electric** (**A.C. and D.C.**), and **steam** in all the following types :— First comes the attractive G.W.R. 2–6–0 type No. 4431, as illustrated, a model any enthusiast can be particularly proud of, and then the speedy L.N.E.R. 2–6–0 No. 33 a very handsome model, worth its weight in gold. Other types supplied are the Southern Railway colours, No. 866, and the L.M.S. 13000.
- With all their accuracy of detail speed, and high-class finish, these models are moderately priced at 5 guineas each. They are locomotives that the owner WILL ALWAYS BE PROUD OF. They **LOOK** the real thing and they **ARE** the real thing.

ASK Father to get you a BASSETT-LOWKE locomotive this year. It's time you had a really good scale model locomotive, and we can supply it ! You can also get hand-made wood coaches and wagons to match. And Gauge 1 enthusiasts need not be deterred. We can supply similar locomotives for this gauge at slightly higher prices. Call and see our models at High Holborn, or send to Northampton for our Catalogues.

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Have you seen our brand new Gauge " O " Station " ASHFIELD "—really magical production of a London Transport Suburban Station with posters and advertisements. Only 25/–.

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BRITISH MADE

BRITISH MADE—

LOTT'S BRICKS

FOR YOUR MODEL RAILWAY

—IN STONE

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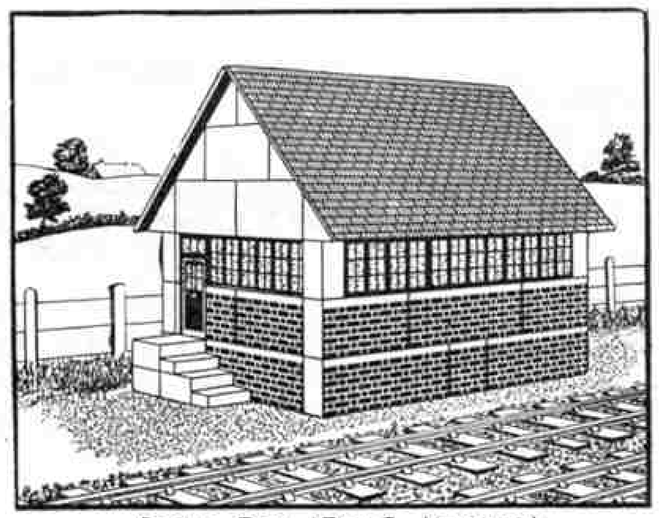
The models can very satisfactorily be permanently stuck together with Seccotine.

Lott's Bricks are made in three different series, as described in the opposite column. Each box is complete with Bricks, Roofs, and Plans for the number of models stated below.

Obtainable from all leading Toy Dealers and Stores

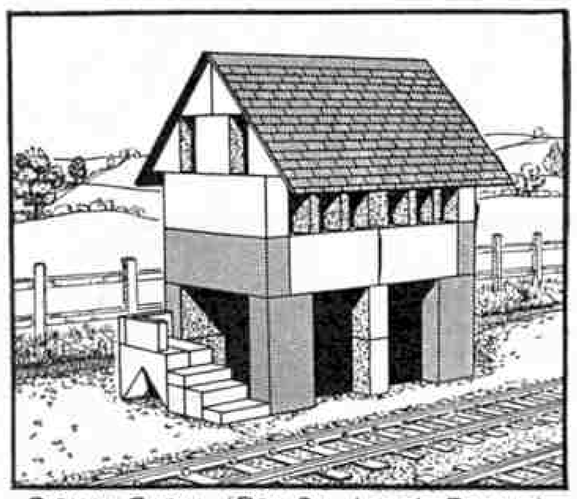


SIGNAL BOX. (BOX 3. LODOMO).

LOTT'S BRICKS
These are the original bricks, and can be used for constructing all kinds of stone buildings, from a great Cathedral down to a small Farm Shelter.

LODOMO
The boxes in this series, with its Flemish bonded red brickwork and bright green doors and window frames, make perfectly realistic models, which are especially effective for all miniature displays.

TUDOR BLOCKS
A really delightful series of stone bricks, with which many beautiful buildings in the old English half-timbered style can be made. The designs include Cottages, Market Buildings, Village Halls, and Old Manor Houses with thatched roofs.



SIGNAL CABIN. (BOX OA. LOTT'S BRICKS).

LIST OF PRICES

LOTT'S BRICKS

Box 0.	6 Models	...	2/–
,, 0A.	12 ,,	...	3/3
,, 1.	30 ,,	...	5/–
,, 1A.	12 ,,	...	5/6
,, 2.	48 ,,	...	10/–
,, 2A.	18 ,,	...	10/6
,, 3.	72 ,,	...	17/6
,, 3A.	(Supplement)	...	7/6
,, 4.	84 Models	...	25/–
,, 4A.	(Supplement)	...	7/6
,, 5.	100 Models	...	35/–

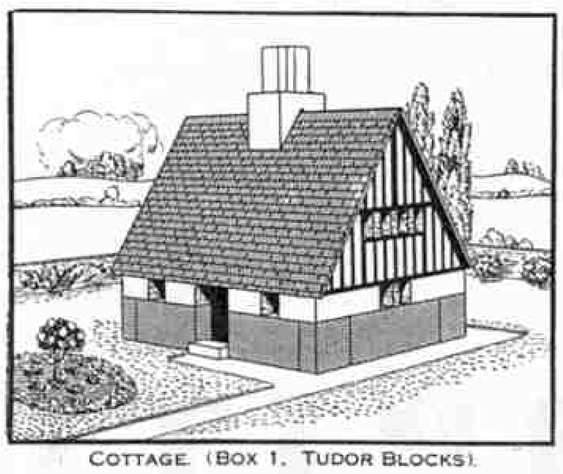
Boxes 1, 1A, 2 and 2A contain Trees and White Paling Fences.

LODOMO

Box 1.	18 Models	...	3/6
,, 2.	50 ,,	...	7/6
,, 3.	72 ,,	...	12/6
,, 1A.	(Supplement)	...	4/–
,, 2A.	,,	...	5/–
Railway Box		...	17/6

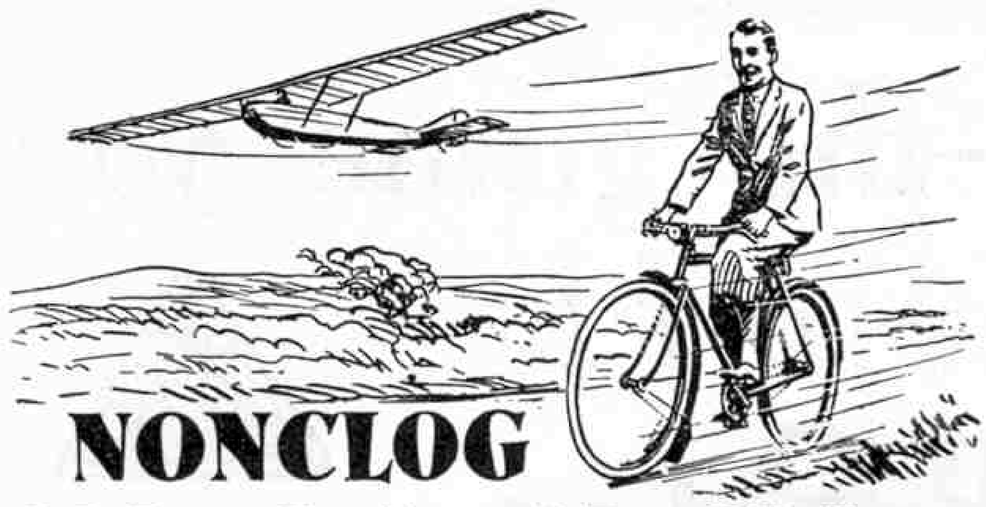
TUDOR BLOCKS

Box 1.	12 Models	...	3/6
,, 2.	18 ,,	...	7/6
,, 3.	36 ,,	...	21/–
,, 4.	43 ,,	...	35/–
,, 1A.	(Supplement)	...	4/6
,, 2A.	,,	...	10/6
,, 3A.	,,	...	15/–



COTTAGE. (BOX 1. TUDOR BLOCKS).

Write for Free Illustrated Lists to Dept. M.M., LOTT'S BRICKS LTD., WATFORD, ENGLAND



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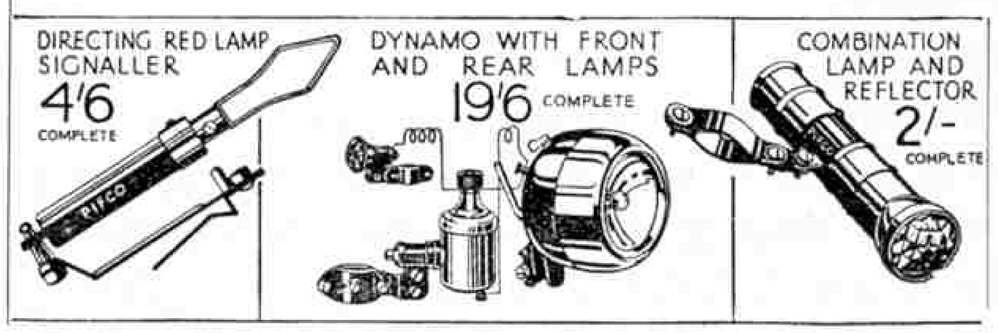

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Then try your skill with several balls—tricky business this . . . but fascinating. A special "Bolo" feature is that each player can devise his or her own individual tricks.

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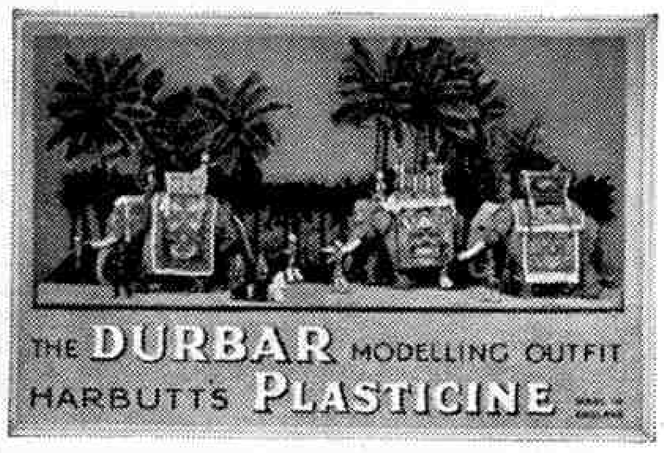

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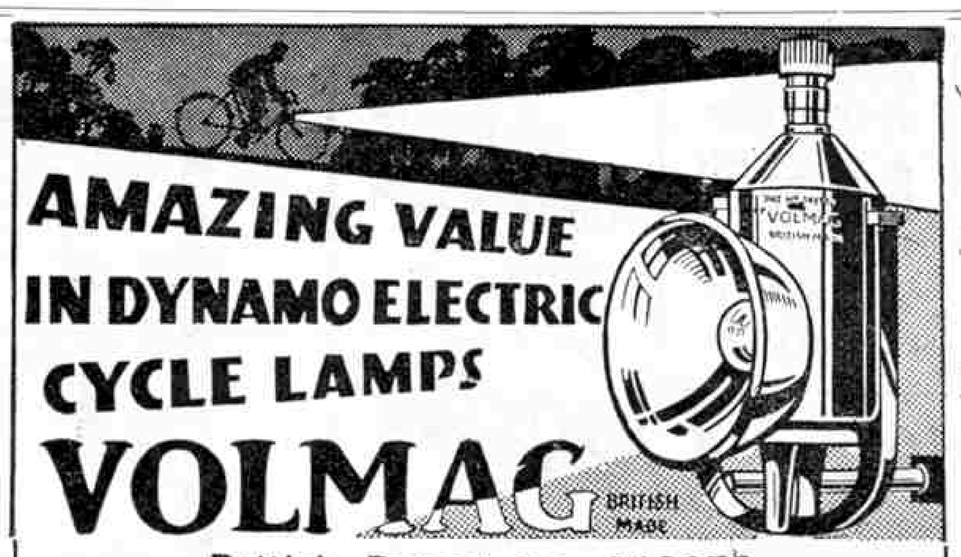

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Mr. E. R. Upwell, nr. Wisbech, writes:— "It is a wonderful invention and **big value for money."**

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Produces its own light by movement of the cycle—

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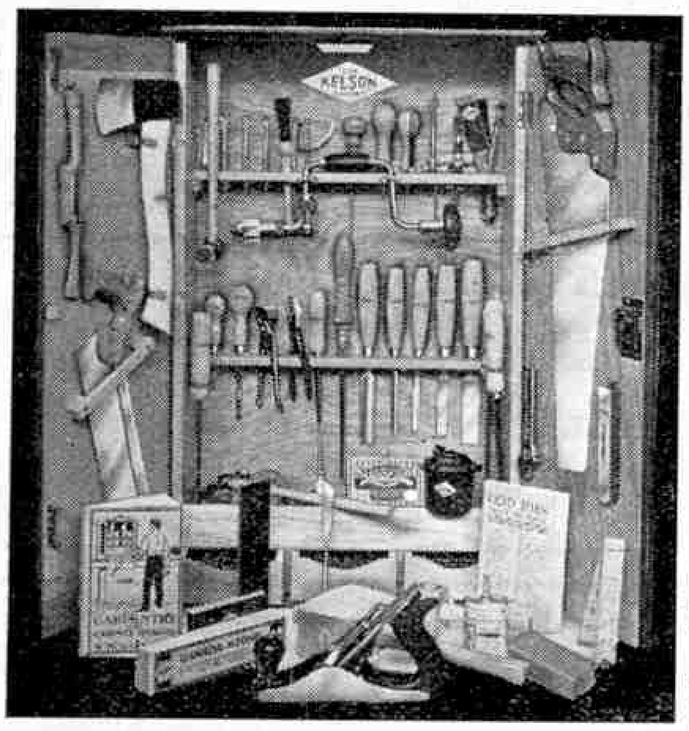

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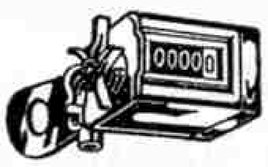

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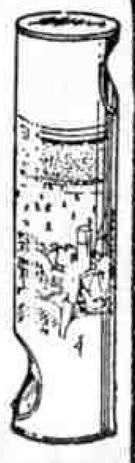

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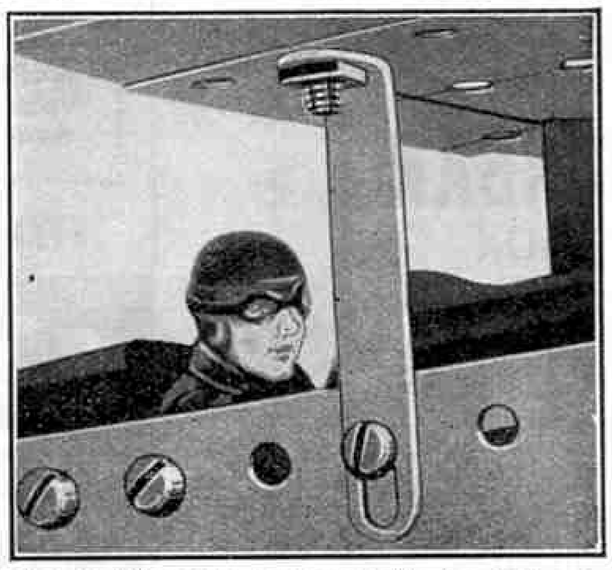

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THE RAILWAY MAGAZINE

PRINCIPAL CONTENTS NOVEMBER ISSUE

The Wycombe Railway (Part II).
British Locomotive Practice and Performance.
L.M.S.R. Locomotives in 1932.
Metropolitan Line Steam Locomotives.
The Great Northern Railway (U.S.A.).
British Train Services in the Summer of 1933.
The Never-Stop Railway.
A "Record of Records" on the L.M.S.R.

The above, fully illustrated, are in addition to the regular features such as "British Locomotive Practice and Performance" and "The Why and the Wherefore."

THE RAILWAY MAGAZINE

MONTHLY Illustrated ONE SHILLING

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Fun with Elektron Outfits—(*Cont. from p. 871*)

the ends of the chain each holding one of the brass Handles—and to see how differently they respond to the action of the current passing through them.

An even more amusing way of making use of the Shocking Coil is illustrated in Fig. 2. One of the brass Handles is dipped in water in a basin, and onlookers are challenged to lift a coin from the bottom of the water in the vessel while holding the second Shocking Coil Handle with one hand. Anyone who does not know very much about electricity is given an interesting lesson in this attractive science if he tries this when the Shocking Coil is working well after careful adjustment for, much to his surprise, he receives a smart shock immediately the ends of his fingers come into contact with the water! The circuit is completed when his hand touches the water, and usually he draws his hand back in surprise when the muscles of his fingers are contracted involuntarily by the passage of the current. More determined efforts do not give any better results, for even if he summons up sufficient concentration to ignore the tingling feeling in his hand and to plunge it into the water, he finds the utmost difficulty in forcing his fingers to close upon the coin.

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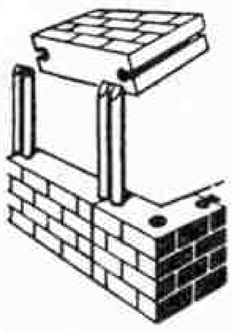

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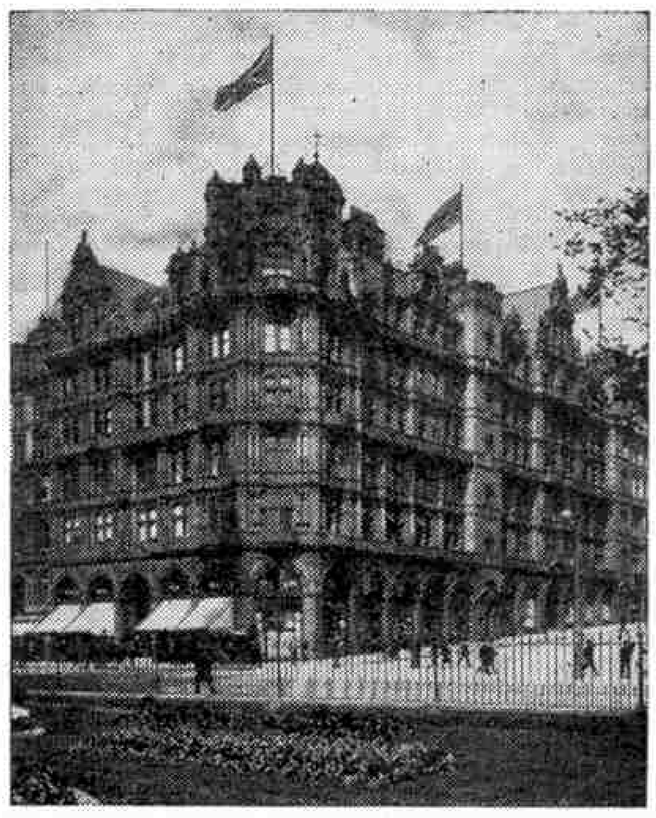

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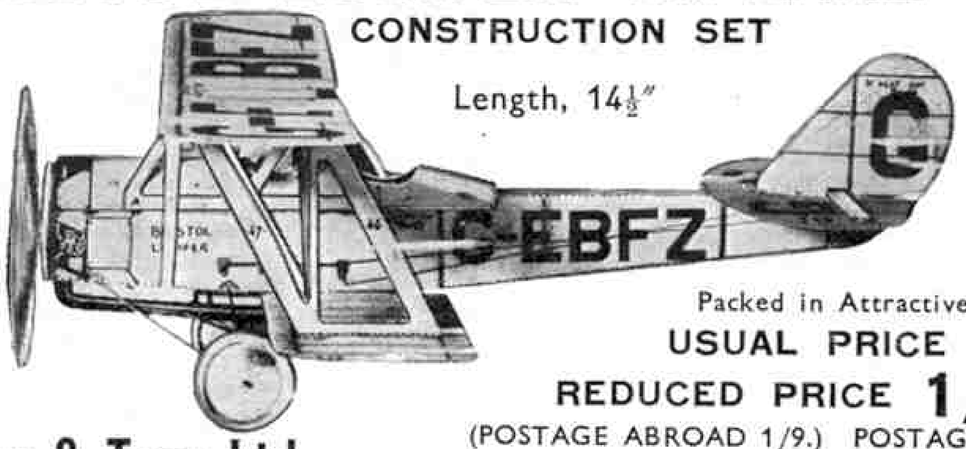

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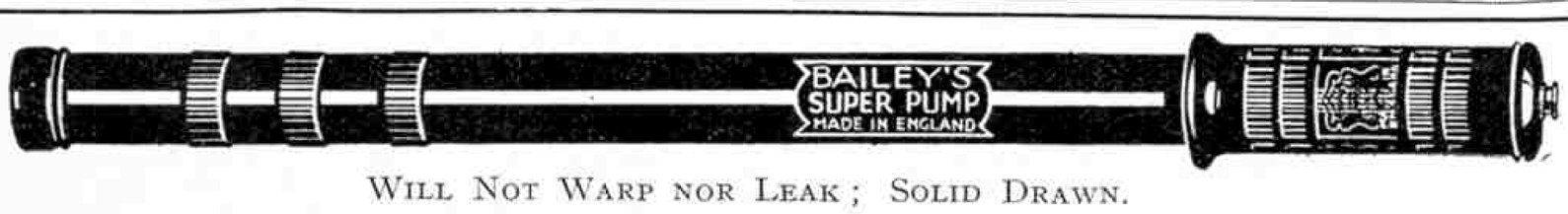

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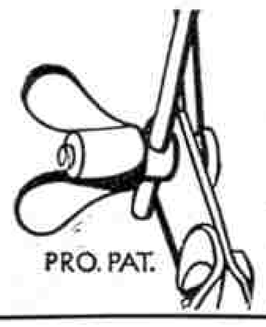

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This Month's Special Articles

	Page
Air News	844
Books to Read	852
Chemical Magic At Home	866
Chemists Who Tried to Make Gold ...	865
Coal Handling by Pneumatic Power ...	830
Competition Page	903
Compound Locomotive Developments	858
Darjeeling—Himalayan Railway ...	860
Electric Eye Counts and Checks Traffic	869
Engineering News	832
Famous British Admirals. IX—Sir George Rooke	840
Fighting Famine in India	842
Fireside Fun	897
Ford Salvage Plant	828
Foreign Aeroplanes of Unfamiliar Type	846
From Our Readers	862
Fun with Elektron Outfits	870
Guild Pages	886–7
Hornby Railway Company Pages ...	889–895
How New Patent Act Affects Inventors	850
In Reply—Meccano Section	885
Interesting Miniature Railway... ...	883
Making High-Speed Transmission Gears	826
Meccano Rotoscope	872
Model Building Contest	881
Model Building Contests Results ...	879
New L.N.E.R. Tourist Trains	854
Our Wonderful World	836
Queen Charlotte Islands	834
Railway News	856
Stamp Collecting	899
Stamp Gossip	901
Story of Rope	838
Suggestions Section	874
What Shall I Be?	848

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Chemistry—(*Continued from page 865*)

to revolve round the heavier particle in its centre. Similar pictures represent the heavier elements, protons and electrons associated directly with them forming in each case a nucleus around which free electrons rotate in orbits of various shapes and sizes, like planets in a miniature solar system, and the elements differ only in the numbers and arrangement of the protons and electrons in their atoms.

It will be seen that in a sense the old alchemists were right, and scientists have looked round for some means of changing the number of protons and electrons in various elements in order to convert it into others. The plan that has been adopted in practically all the experiments so far carried out has been to bombard the atoms in the hope of knocking electrons out of them, or of breaking them up into smaller atoms. For such tiny targets very tiny bullets are necessary, and elements therefore have been bombarded with electrons shot out at high speed from the cathodes of vacuum tubes and also with the much heavier particles, which are hurled out of radium and other radio-active substances. In this way a few light elements have been broken up, chiefly into helium and hydrogen, but the results are disappointing, for very few of the tiny missiles from the guns that the scientists use appear to strike their targets. Extremely violent electric shocks also have been tried, with even less effect, and the alchemist's dream of transforming tin and other base metals into gold remains unfulfilled. It is doubtful if there would be any advantage in such a transmutation, for gold is too soft to be put of any practical value except as a means of exchange, and to flood the world with the precious metal made in this manner would make us poorer in useful materials.

Miniature Railway—(*Continued from page 883*)

corner, where the sea and cliffs form a striking background, in strong contrast to the industrial element included in the photograph described previously.

The other two photographs show views of the main station, where the arrangement of the scenery is such that the station is situated centrally on the shores of a wide bay. Behind the station buildings a pier is shown jutting out to sea, and various craft appear here and there in the bay.

The remainder of the scenery is chiefly agricultural in character, and over the tunnel previously mentioned realistic farm buildings are arranged.

The line is very completely provided with accessories of various kinds. A footbridge constructed of Meccano connects the main platforms of the principal station. Numerous signals govern the working of the trains, and lamp standards illuminate the chief premises and yards. In addition, train indicators of various kinds, and telephone boxes, appear on the station platforms, and good use is made of the Hornby Posters. Many miniature figures are employed on the stations and on the railway generally, together with various items of miniature luggage with the appropriate barrows.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—

LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/– for six months and 16/– for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

STAMPS ON APPROVAL, ¼d. each and upwards. 25 different Stamps free to applicants.—R. Watson, 33, Dalgairn Crescent, Cupar, Fife.

THE WESTERN STAMP SERVICE, SKEWEN, GLAM.
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MECCANO

MOTOR CAR CONSTRUCTOR OUTFITS

MECCAUTO 538189

No. 1 Motor Car Constructor Outfit

One of the most fascinating of all boys hobbies, either indoor or outdoor, is model car operation with cars built from Meccano Motor Car Constructor Outfits. Perfect miniature reproductions of many different types of car can be built with these splendid Outfits, including sports four-seaters, speed cars, sports coupés and others.

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The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples illustrated at the left-hand side of this page and think of the fun you could have building these and other types equally graceful and realistic.

No. 1 Outfit is available in four different colour combinations and is supplied complete with powerful Clockwork Motor.

Price **14/6**

No. 2 Meccano Motor Car Constructor Outfit

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the illustrations at the right-hand side of this page.

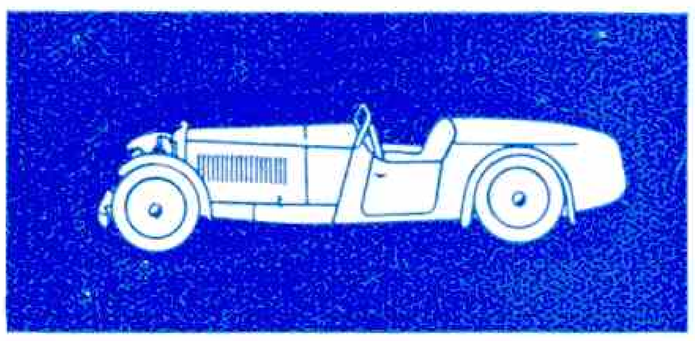
No. 2 Outfit is available in four different colour combinations, and a powerful Clockwork Motor that gives a run of 150 feet on one winding is included.

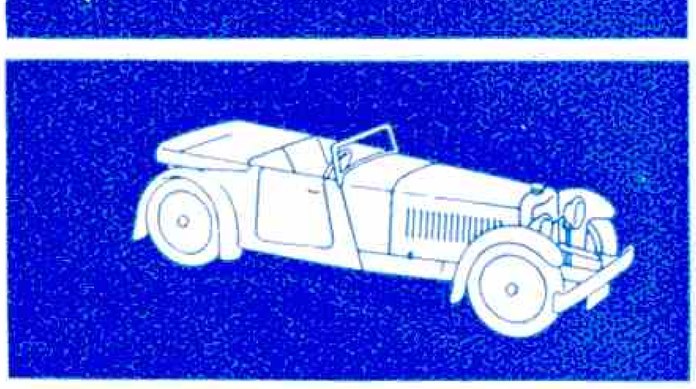
Price **25/-**

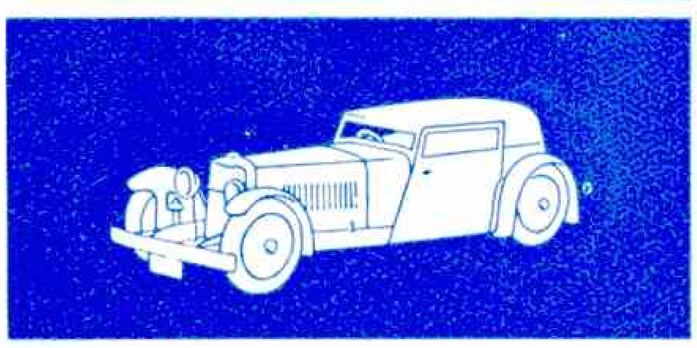
Manufactured by

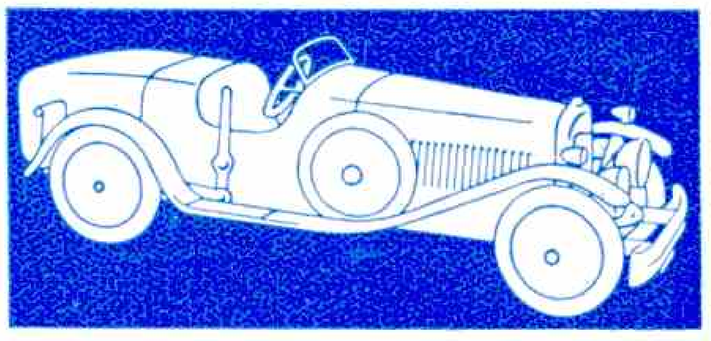
Meccano Ltd., Binns Rd., Liverpool 13

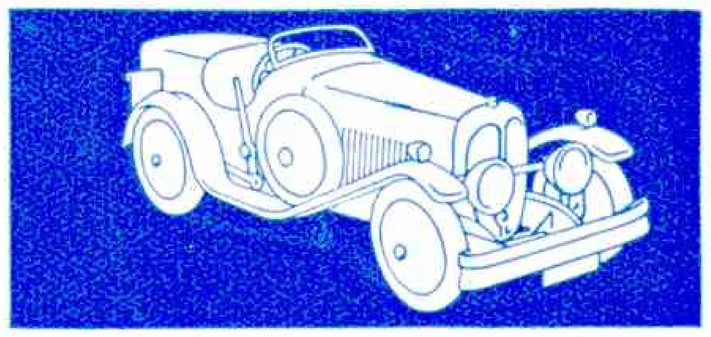
No. 2 Motor Car Constructor Outfit

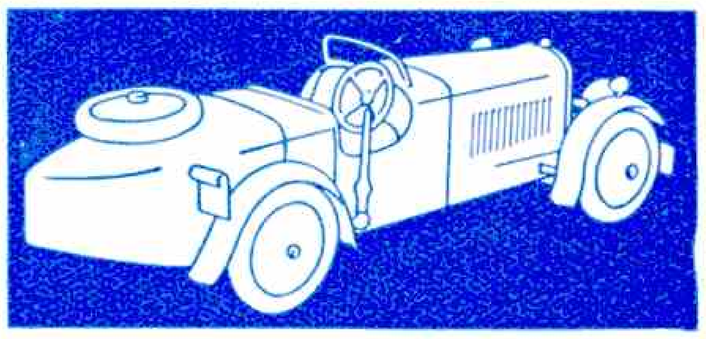








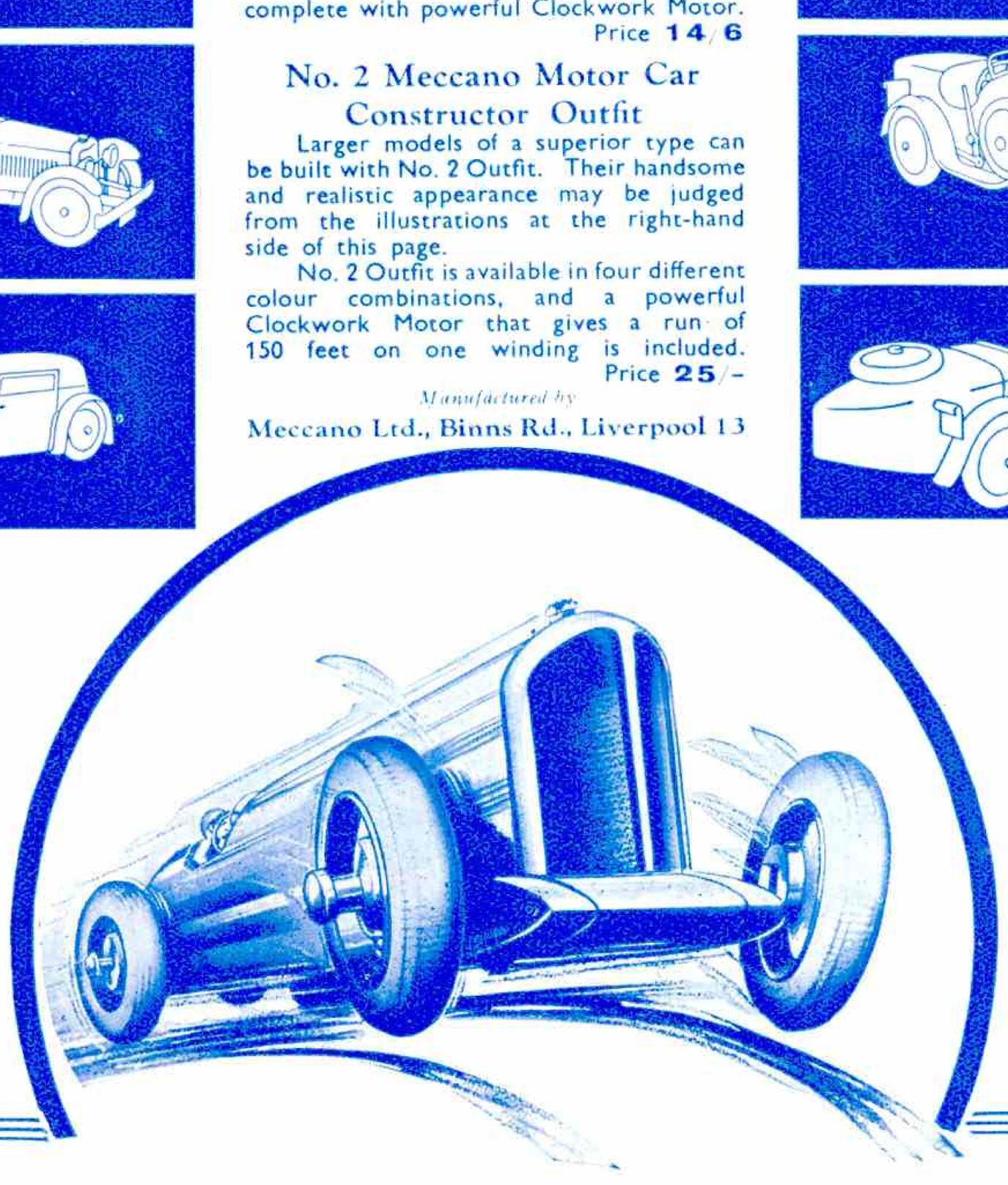




Motor Car Lighting Set

This Lighting Set enables the headlamps of Motor Car models built with the 1933 No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

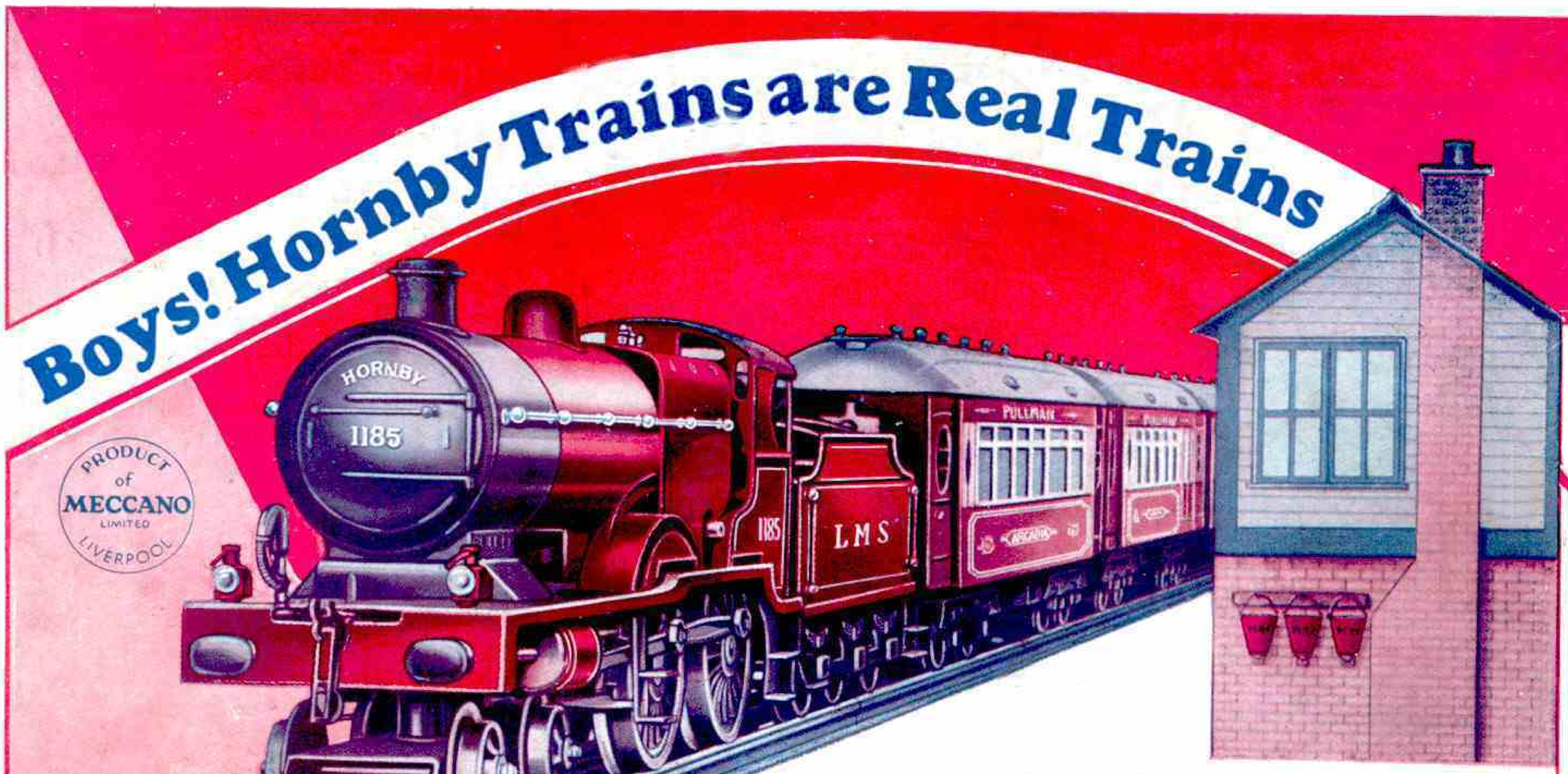
It should be noted that the Lighting Set cannot be used with 1932 type Motor Car Outfit models unless the latest headlamps (price 4d. each) and Instrument Board (price 6d.) are added.



Motor Car Garage

The Meccano Motor Car Garage provides accommodation for any Meccano model motor car or other car of suitable size. It is strongly built, with imitation rough-cast finish. Inside dimensions: Height 5 in., Length 13 in., Width 7¾ in. Price **7/-**

Boys! Hornby Trains are Real Trains



PRODUCT of MECCANO LIMITED LIVERPOOL

The illustration above shows Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive. This Locomotive is a true-to-type model of the real L.M.S.R. Standard Compound Locomotive shown in the illustration below.

A Perfect Miniature Railway

Hornby Trains are such great favourites with boys because they enable almost every operation in real railway practice to be carried out accurately and efficiently.

Hornby Locomotives are 100 per cent. efficient. No others run so smoothly. No others pull such heavy loads. No others haul trains so far on a single winding.

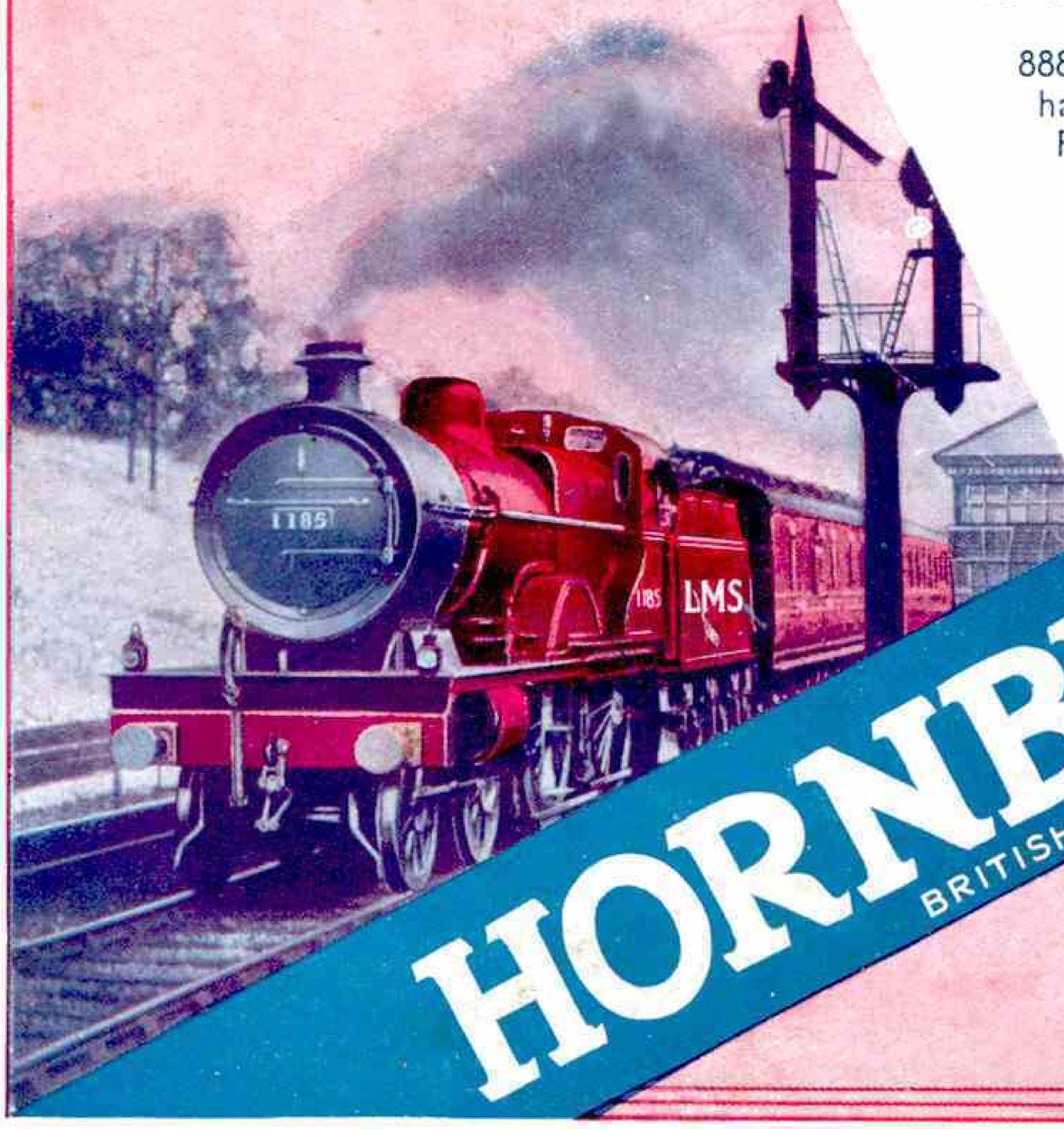
Hornby Rolling Stock is smooth-running and durable. The range includes almost every type seen on the big railways.

Hornby Accessories are realistic and in correct proportion. They provide everything a boy could wish for to make his railway a complete representation of the real thing.

Get a copy of the Hornby Book of Trains (see page 888 inside) and make your choice now. If you prefer to have an ordinary price list you may obtain a copy of Folder No. 6 from your dealer free of charge or direct from Meccano Limited, price 1d. Write to Department A.M.

This must be a Hornby Christmas for every boy who is keen on model trains!

Prices of Hornby Train Sets from 5/- to 85/-



HORNBY TRAINS

BRITISH AND GUARANTEED

Manufactured by
MECCANO LIMITED
Binns Road
LIVERPOOL
13

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